NOVEMBER • 1956
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ELECTRICAL CONSTRUCTION AND MAINTENANCE

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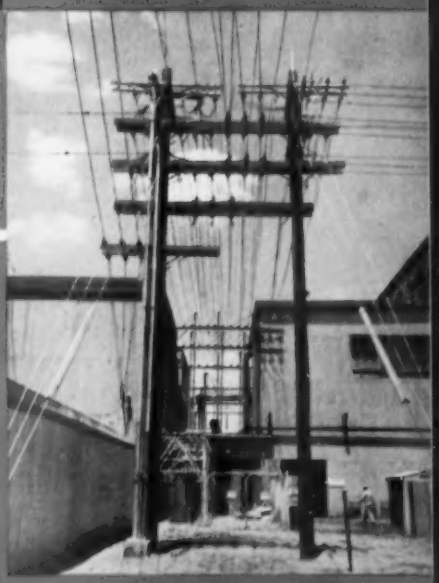
MODERN LIGHTING TECHNIQUES at Cleveland's new airport.

page 75



Electrical distribution details at Anaconda's New Mexico uranium ore processing plant.

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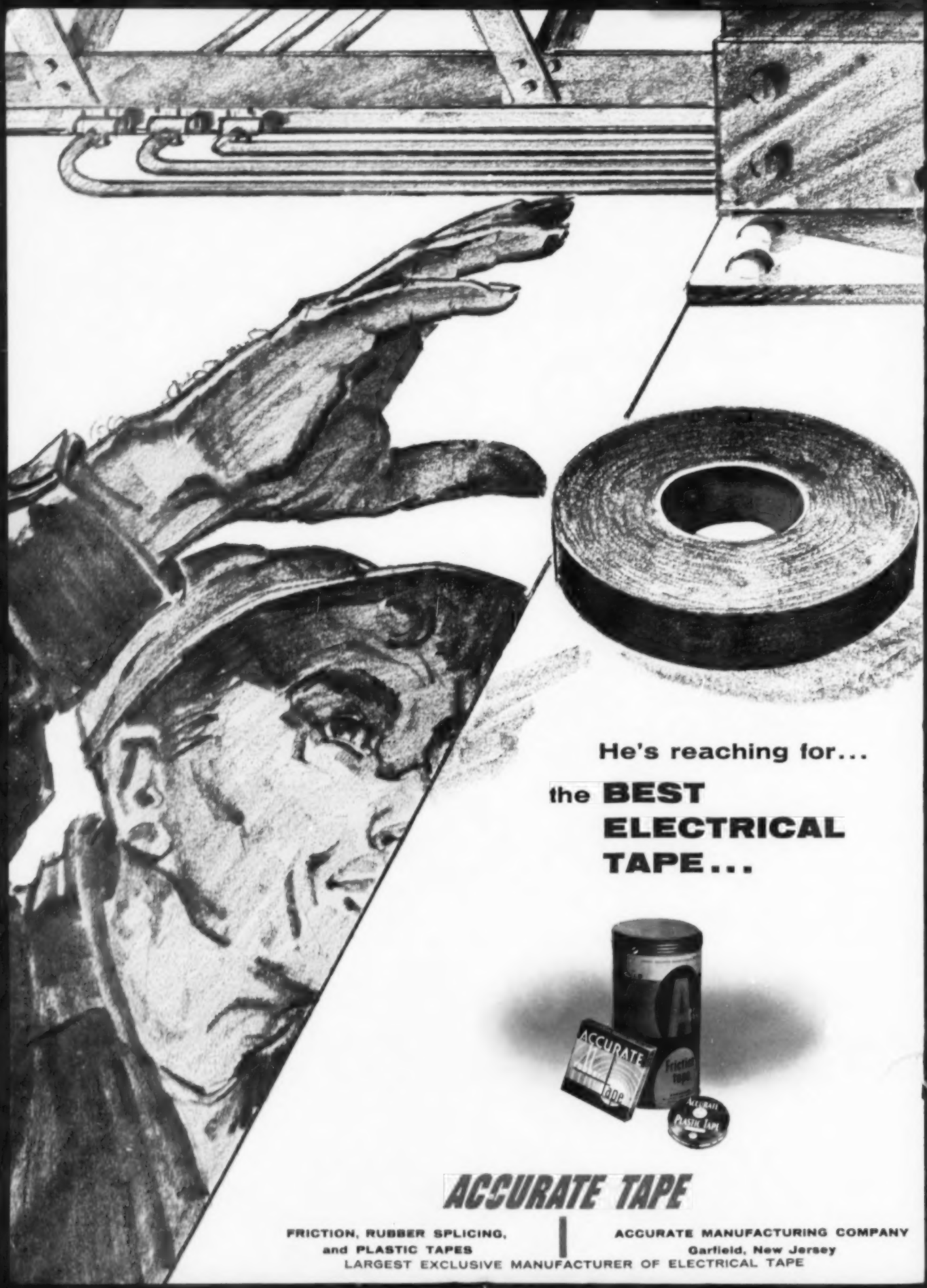
56TH YEAR



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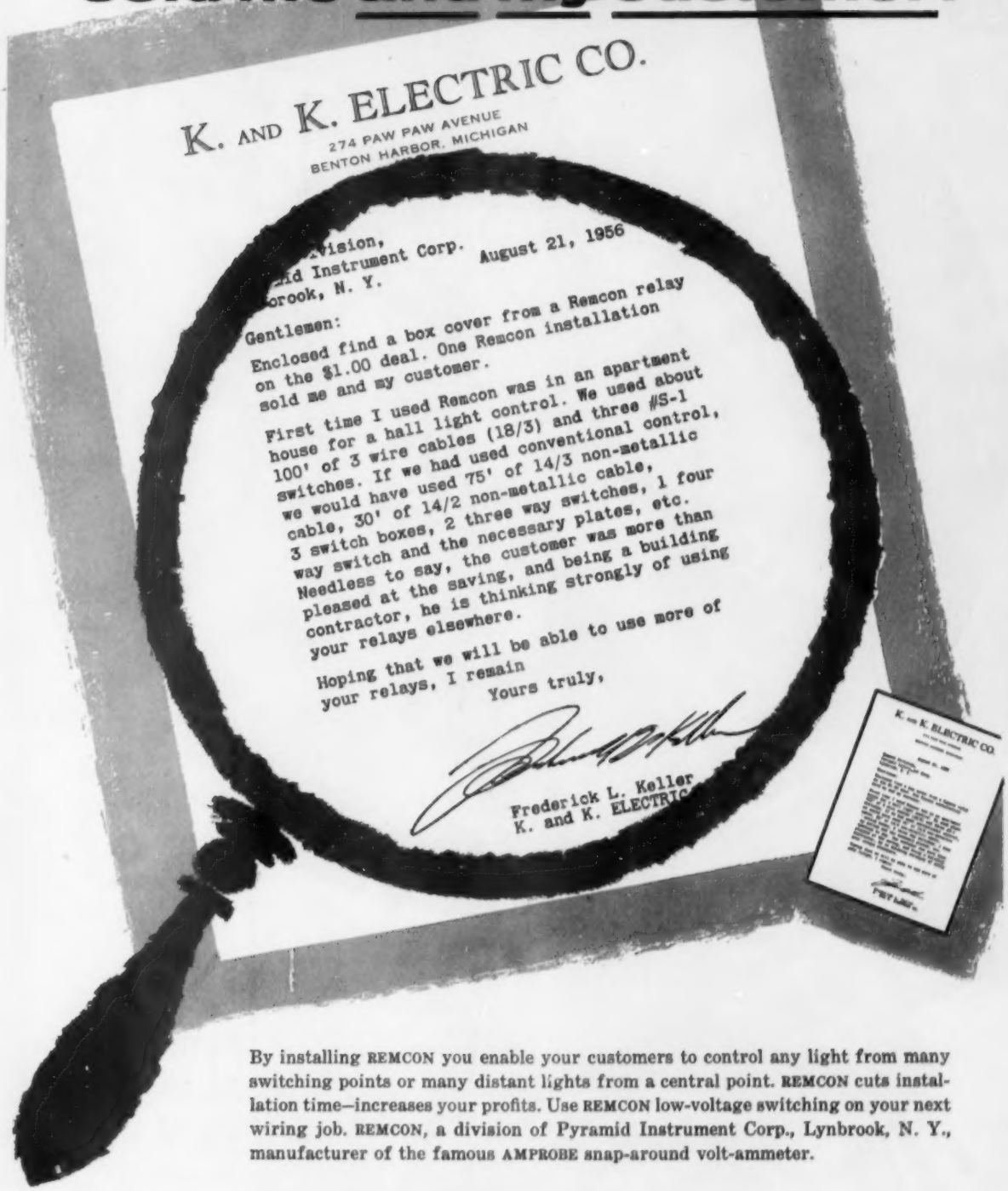
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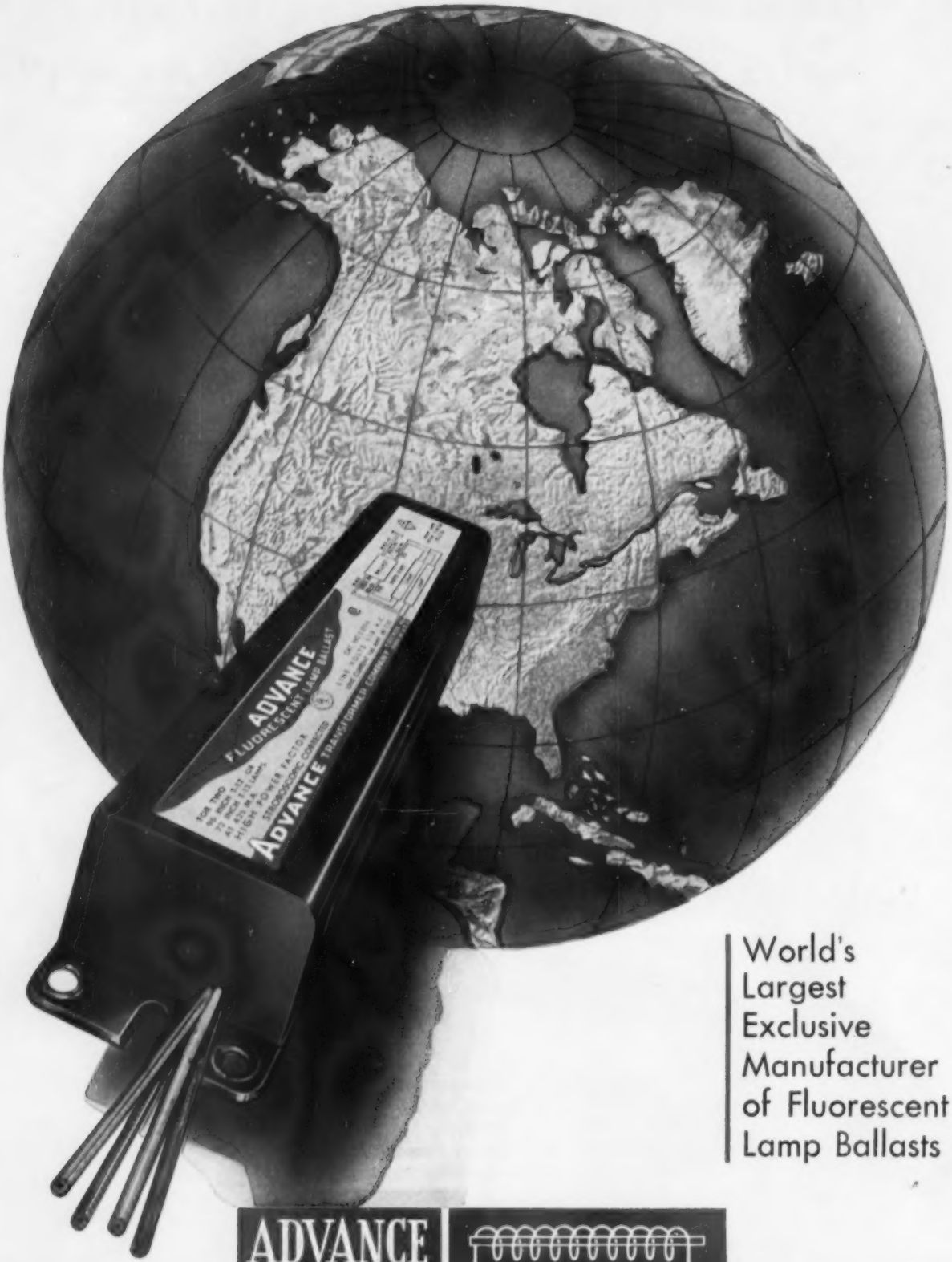

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Sidelights

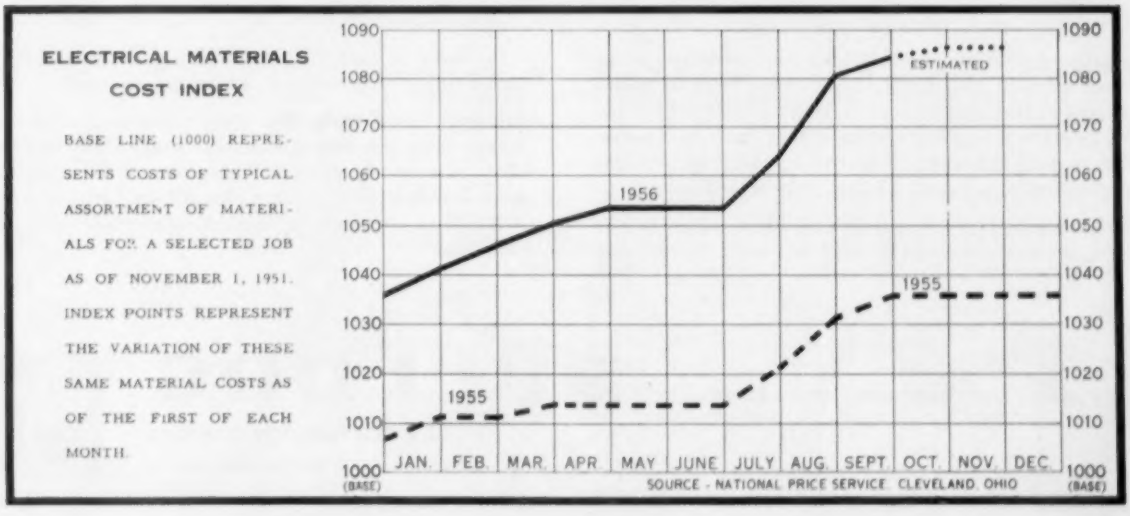
NECA IN SAN FRANCISCO–Over 2000 members and guests of the National Electrical Contractors Association gathered in sunny San Francisco for the annual NECA Convention and trade show, September 25-29. For the participating delegates, there were a series of well-planned meetings and conferences dealing with current industry problems and prospects; for families and guests, a round of social events in one of America's most charming and hospitable cities. Our convention coverage this year was prepared by Associate Editor Alice McMullen and Western Consultant Bill Cyr in a different format from previous years. The new story layout provides more flexibility (and consequently better editing) in the short time available before deadline. Personalities caught by the editorial cameras in meeting rooms and corridors are presented as a pictorial feature, "Flashguns in San Francisco", begins on page 82. The news and meetings activities story heads "In the News" beginning on page 254.

SHUTTERBUGS–Amateur photographers, that is, may be interested in a flutter technique for taking pictures in busy public places, when it is desired to exclude images of moving vehicles or people from the photograph. The answer is to set the shutter at "Time" (using a tripod and small lens aperture to gain steady support and maximum depth of field), then make numerous short exposures by fluttering something opaque (such as your hat) in front of the lens. Stationary objects within the field of view will of course receive the summation of all these brief exposures, but a moving object (appearing in one place for only a fraction of a second) will be so underexposed that it will make little or no impression on the film. This technique was used several times by Industrial Editor Scott while he was taking pictures at Cleveland's new airport terminal and, although cars and people were passing in front of his camera constantly, the impression of movement in the form of blurred images is almost completely absent. You will find the results of this technique, together with his story concerning the airport's up-to-the-minute lighting and distribution system appearing on page 75.

NEW CODE–The 1956 Revision of the National Electrical Code will become effective during the next few months over most of the United States. The new edition will supplant the current 1953 Revision and brings the Code up to date incorporating interim amendments and approved code panel recommendations of the past three years. The changes in the new Code are numerous but mostly in detail or to "cover" new methods or products. Some are editorial, to clear away ambiguities or to make intent more obvious. Behind them all is a great deal of work and discussion by very able and experienced industry experts. Dean of our "Questions on the Code" department, B. A. McDonald, reviews for us this month the change in the new Code and gives some of the background of the new rules. His analysis, "'56 Code Revisions" begins on page 85.

BID SPREAD CORRECTION–If you were confused by the captions under the illustrations in the "Bid Spread" article on page 129 of the October issue, we can't blame you. We were, too, when the issue came off the presses. Such errors occasionally plague editors. We try our best to prevent them. This time we got it, but good. Our apologies to Author Ashley and the readers.

Naturally, the estimate on page 129 shows the effect of using separate or common markups on a $100,000 base cost project. The recap on top of page 130 shows a normal bid for the $10,000 base cost job discussed in the text. The pricing sheet on the bottom of page 130 shows the below-normal bid of contractor; while that on top of page 131, recaps the above-normal bid of contractor B for this same project.



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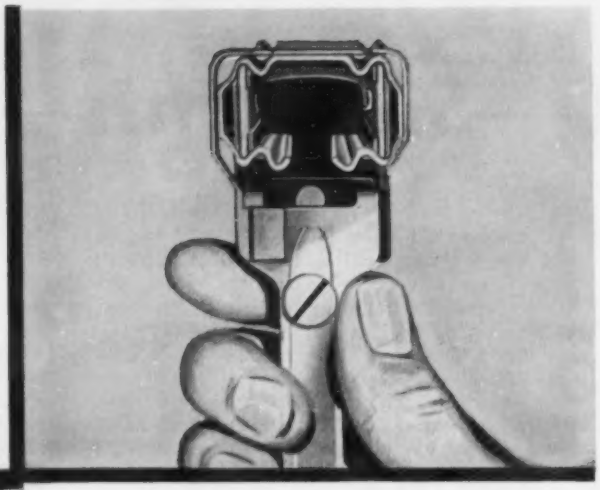

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Washington Report

Gross national product (GNP) leveled out during 3rd quarter at about $414-billion annual rate, a new record. But the increase over 2nd quarter $408-billion annual rate reflected higher prices—not more goods and services—explains partially the Federal Reserve Board's continued inflation curbs in the form of tight credit.

The FRB's hard money policy is expected to continue so long as the inflation danger continues, in spite of every day pressures from business—home builders, truckers, etc.—for easing of credit curbs. FRB acts independently of White House, Council of Economic Advisers, and the Treasury.

Homebuilding dropped to 93,000 units in September, lowest level for the past 22 months. Total for 1956 is now estimated at about 1,050,000 starts, at a total cost of some $15-billion.

The Administration's four-point relaxation of credit rules put in effect in September have not checked the decline. In mid-October the White House ordered further liberalization in the form of more direct VA loans to veterans.

Outlook for homebuilding is confused. Administration spokesmen predict a slow up-turn, stimulating activity by next spring; while industry leaders see tight mortgage money curbing housing starts seriously until the credit curbs are removed.

Census Bureau will make a comprehensive housing survey in December, covering 21,000 sections of 638 counties in all 48 states, to help the government determine whether the nation has overbuilt—in its rush to put up new apartments and houses. Survey will cost some $1-million, will be first housing survey of this scope since 1950.

New construction spending dropped from August level in September to $4,267-million, but was still above the $4,148-million level of September last year. The September decline was seasonal, Dept. of Commerce reported. But new trends are cropping up that may bear watching:

—Office building outlays are soaring. Value of work put in place is running about 25% ahead of a year earlier.

—Industrial construction gains are tapering off. The totals are not down, but the comparison is with 1955's rocketing figures.

—Construction of stores, restaurants, etc., which were running ahead some 30% to 40% early this year as compared with similar months in 1955, are now on the minus side—down 9% in August, 19% in September.

—Building costs are up about 3% over a year ago, and continuing upward. Some home builders credit high prices for slowing down housing starts.

Industrial output in September hit a record level of 144% (FRB Index), same as for last December, seemed sure to climb higher in October due to record steel production and gains in auto production on new 1957 models.

Personal income has hit a new high of $328-billion (annual rate), up $19.5-billion from a year ago. Wage-and-salary income made the big gains (in the "new round" of pay increases, and in increased employment), but personal receipts from interest and dividends also showed gains, up $2.8-billion annually for more than a 10% gain.

New industry representative in Washington for electrical manufacturers is Harold J. Vorzimer, vice president of Federal Pacific Electric Co., Newark, N. J., who has been appointed Director, Electrical Equipment Division, Business & Defense Services Administration, Dept. of Commerce, Washington, D. C.

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Electrical Consulting Engineer: McGregor, Anderson and Beynon, Toronto, Ontario

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THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

What Can Be Done About It?

There is no easy or quick way to overcome the shortage of scientists and engineers that has become a threat to our national security and economic progress. The solution can come only through diligent efforts extending over several years to bring the supply of technically trained people into balance with our needs. Meanwhile, the pressure of the shortage can be relieved if industry, government and education make better use of the limited number of scientists and engineers now available.

Earlier editorials in this series have discussed the dimensions of the shortage of technical manpower, its meaning for our national security and our economic well-being and the causes of the shortage. This final editorial will survey some of the measures that can be taken to overcome the shortage. Most of the proposals presented here have been suggested elsewhere. But in combination they appear to offer the best hope of an answer to this serious national problem.

Soviet Methods Not For U. S.

It is clear that no crash program, inspired by panic and designed indiscriminately to drive hordes of high school students into science and engineering, is suitable for the United States. Even if we adopted Soviet methods of channeling a large portion of our brightest young people into technical fields, it would be at least four years before results appeared in the volume of college graduates. And such an approach would do no credit to the American way of life.

Any crash program, whether it involved totalitarian methods or simply overselling the advantages of technical careers, would be objectionable for other reasons as well. It would jeopardize the quality of scientific and engineering training. It would put many young people in fields where they have little aptitude and deny them to other fields for which they are better equipped. And, if carried too far, it might even result in the overcrowding that was feared prematurely a few years ago.

The most important problems for the long run, as the preceding editorial in this series indicated, are in the area of education. Any real solution must reduce the loss of talented high school graduates who do not continue their education for financial reasons or because of lack of interest. Also, it must improve the quality of high school preparation in science and mathematics and, above all, relieve the critical shortage of teachers.

Basic Needs in Education

Substantial increases in salaries of teachers in most of the nation's school systems are essential if high school students are to receive adequate preparation for courses in science and engineering. Pay scales that have lagged behind rising living costs and salaries available in industry have placed great strain on even the most devoted teachers. There has been a sharp drop in the number of new graduates trained to teach science and mathematics, and of this smaller number many have decided not to follow careers in teaching.

Raising teachers' salaries to more realistic levels must be primarily the job of local school districts, aided by state governments. If, in face of rapid increases in school enrollments, local and state resources prove insufficient, then federal aid will have to be considered. Higher teachers' salaries, however financed, inevitably mean higher taxes. But without appreciable improvement soon, the quality of our entire educational system is in danger.

At the college level also, financial aid is needed to provide scholarships for promising students and to increase faculty salaries. (An earlier series of editorials dealt more fully with these problems, and business aid to higher educational institutions has been mounting at a gratifying rate.)

But not all the educational problems related to the shortage of scientists and engineers can be solved with money. Science and mathematics have steadily been de-emphasized as more youngsters have gone to high school for terminal education rather

How business is helping to relieve the shortage of technical manpower

Summary of a Survey by McGraw-Hill Correspondents

Sponsoring summer study programs for high school teachers
Arranging cooperative work-and-study programs for students
Sponsoring college fellowships and scholarships in science and engineering
Paying tuition of employees taking science and engineering courses
Keeping college faculties abreast of new developments in industry
Hiring high school science teachers for summer and part-time work
Giving old, but usable, laboratory equipment to schools
Cooperating in high school science exhibits
Sponsoring regional science fairs
Sending speakers and training aids to schools
Opening plants for student tours
Analyzing jobs to relieve engineers and scientists of routine work

The McGraw-Hill Department of Economics will be glad to hear of any other ways business is helping relieve the shortage.

than for college preparation. This de-emphasis must be reversed.

Techniques of instruction, furthermore, can stand improvement at all levels of education. Professor E. P. Northrup of the University of Chicago observes: "In the past fifty years . . . there has been a revolutionary change in the character of mathematics, yet not a trace of this change is to be found in the curricula of all but a handful of secondary schools throughout the country." Colleges and universities may have to examine old fetishes about light teaching loads and small classes in order to make more efficient use of their faculties.

What Industry Can Do

Industry has the immediate problem of better utilization of available technical manpower and the long-range responsibility of helping increase our resources of trained people. Frantic recruiting practices and reckless bidding up of starting salaries—financed largely by government money for defense orders — are not the answer. There is need for earnest consideration of incentives for experienced scientists and engineers, who too often must look to sales or executive positions for adequate financial recognition.

Industry in many instances could make more efficient use of engineers and scientists by shifting work to technicians, clerical personnel and even machines. One company found that 15% of the time of an engineering design group was spent on routine jobs and that this valuable time could be saved by adding a technician and a clerical worker to the group.

Other potential sources of technical manpower could be tapped more extensively to relieve the shortage. Very few women have entered what has been traditionally a man's world. Negroes are only slowly gaining educational and employment opportunities in technical fields. And many experienced older men can still give useful service.

A Good Beginning

Much is being accomplished already in efforts to attract more young people into scientific and engineering careers. A summary of some of the things business is doing is presented above. Other notable contributions are being made by such organizations as the professional engineering and scientific societies (especially through their manpower commissions), the National Science Foundation, the National Research Council, the National Education Association, the National Merit Scholarship Foundation and the Thomas Alva Edison Foundation.

Results are beginning to appear in rising enrollments in engineering schools and technical institutes. Between 1951 and last year, according to McGraw-Hill's annual survey of technical institutes, enrollments in these schools rose from 46,000 to a record 67,000. Engineering enrollments rose in the same period from 166,000 to 243,000. A rising tide of graduates is already being made available to American industry.

This is a good beginning. But only with wider appreciation of the serious implications of the shortage of scientists and engineers and intensified efforts on the part of business, government and education to relieve the shortage can we hope to overcome this threat to our national security and economic well-being.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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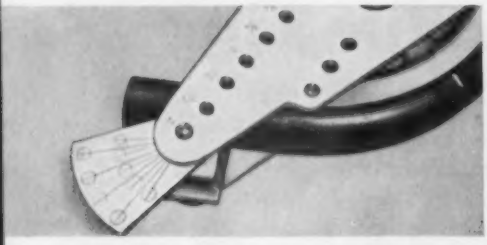
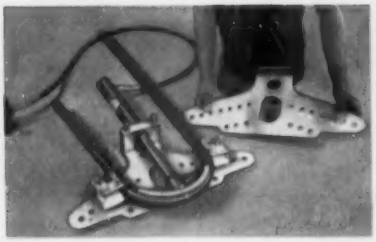


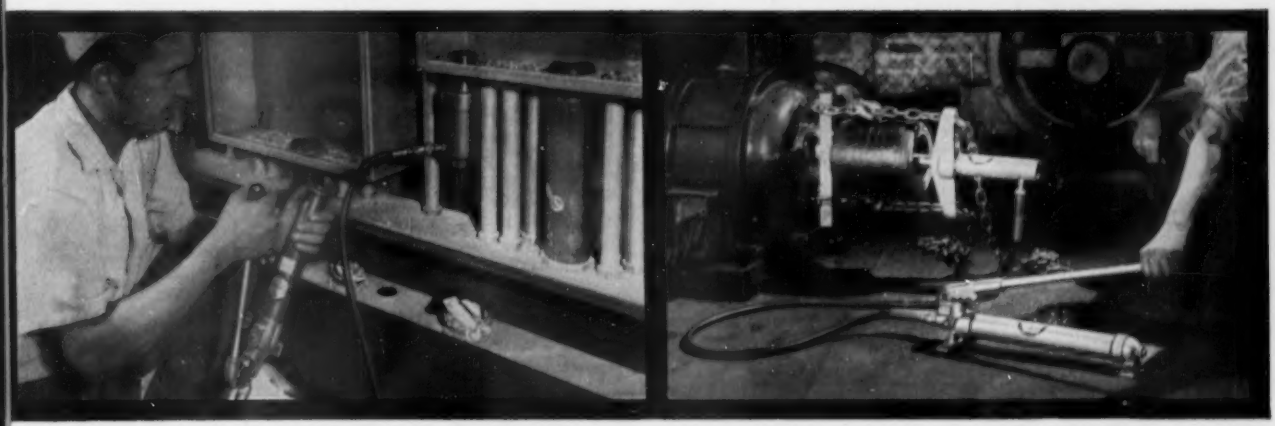
NEW "OPTIK-ANGLE" GAUGE eliminates guesswork and time-wasting measuring in controlling degree of bend — shown by above simple gauge, which is mounted right on bender.



NEW LONGER STROKE RAM extends to full 10 inches. Makes 90° bends in one stroke and with only one setting of pipe in the shoes. Also forms bends up to 180° faster than ever!

NEW REMOVABLE TOP PLATE—"Lock-On" shoes speed setups — eliminate need of threading shoes on ram. Simply set in place. Pipe quickly positioned from above. One latch unlocks top plate.

Tools bring ease, speed, profit to electricians



HANDY LIGHTWEIGHT KNOCK-OUT PUNCHES ARE 60% FASTER! Now you can get Blackhawk hydraulic Knock-out punch equipment any way you want it — in kits to fit your work and budget. Speedy hydraulic unit is now 9 lbs. lighter, lower in cost. Gets in tight places. No wrench to swing — no bashed knuckles. You get neater holes, more ease and safety.

THESE HYDRAULIC TOOLS DO 1001 OTHER BIG JOBS! The same "Porto-Power" hydraulic units that power Blackhawk electricians' equipment lick dozens of allied push, pull, bend, clamp, press and lift jobs — speed up scores of tasks, as in fast pulley pulling above. You get *so much more* for your money from Blackhawk Pipe Benders and Knock-Out Punches.

BLACKHAWK®

World's largest manufacturer of HYDRAULIC TOOLS

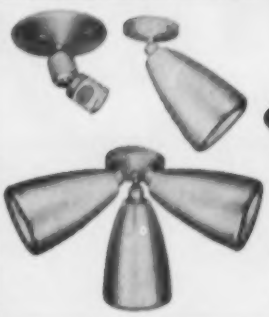
(Prices subject to change without notice)

SELLING PLUSSES for You...

SERVICE PLUSSES for Your Customers

when you install the

amplex Swivelite Line



CANOPY UNITS

In 1-, 2-, 3- and 4-socket types. Furnished complete with 72" of wire leads, knockouts and screws to fit 3¼" or 4" round outlet boxes.

CANOPY EXTENSION UNITS

Add-a-Pipe Lengths: 6", 12", 24", 36". Add-a-Flextension Lengths: 12", 18", 24". Curved Arm Pipe Lengths: 12" and 24". Also pre-assembled Canopy Units complete with Straight, Curved or Flexible Extensions.

BULLDOG TROLLEY and WIREMOLD UNITS

Completely assembled Swivelite Socket Units for easy positioning at any point on horizontal or vertical Bulldog Trolley Ducts. Types for #2100 and #3000 Wiremold Raceways.

SOME OF THE FEATURES

SOME OF THE FIXTURES

1. DOUBLE-BALL SWIVEL

Exclusive free-floating universal joint swivel gives your customers instant, positive fingertip positioning of lamps at any angle.

2. LUSTROUS, LASTING FINISH

The infra-red baked Deluxe Satin Aluminum Finish gives lasting satisfaction — won't chip, discolor or blister.

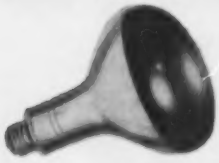
3. AIR FLOW VENTILATION

Your customers get longer lamp life because the 8 ventilating ports in Swivelite hoods carry off excess heat, keep lamps cooler, reduce tendency for bulb bases to loosen.

4. "ADAPT-A-UNIT" CONSTRUCTION

You can easily change Swivelite installations to meet changing needs of your customers—by adding, removing, interchanging Add-A-Pipe, Add-A-Flextension or Curved Arm Pipe Lengths.

Recommend amplex lamps for amplex fixtures



COLORBEAMS will give your customers endless opportunities for colorful, dramatic accent lighting, easily keyed to changing seasons. 8 brilliant, sparkling, guaranteed permanent colors in indoor bulbs; 10 in indoor-outdoor.

SPOTLITES and FLOODLITES fill every need for lighting single objects or entire areas. 40 to 500W for indoor service; 75 to 1,000W for outdoor.

Your distributor carries the complete line of amplex fixtures—also the complete line of amplex incandescent and fluorescent lamps for standard and specialized lighting needs.

For descriptive literature, write

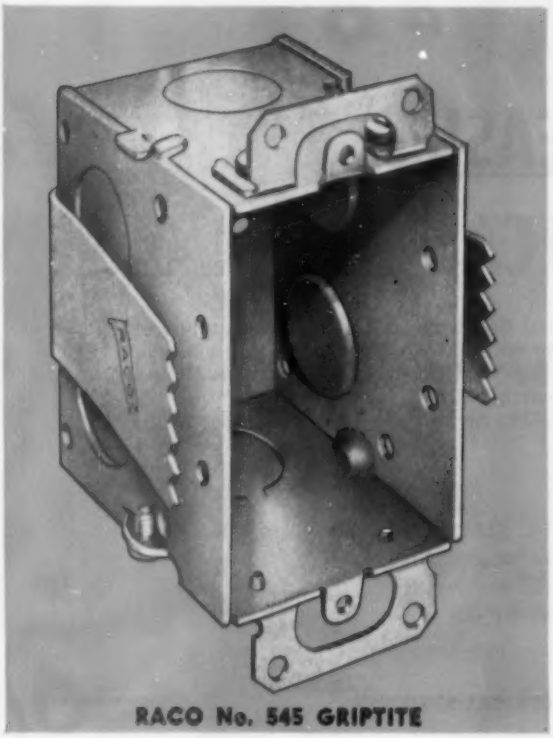
amplex

CORPORATION

Dept. EC 11-56

111 WATER STREET

BROOKLYN 1, N. Y.

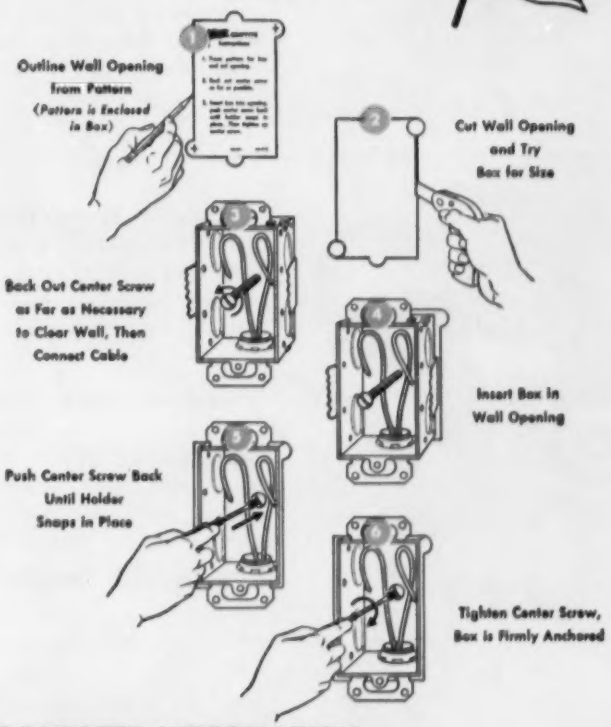


RACO No. 545 GRIPTITE

New RACO GRIPTITE BOX

Saves Time and Money On All "Old-Work" Installations

SIX EASY STEPS TO INSTALL


Outline Wall Opening from Pattern (Pattern is Enclosed in Box)
Cut Wall Opening and Try Box for Size
Back Out Center Screw as Far as Necessary to Clear Wall, Then Connect Cable
Insert Box in Wall Opening
Push Center Screw Back Until Holder Snaps in Place
Tighten Center Screw, Box is Firmly Anchored

- ✓ EASIEST BOX TO SET IN PLACE
- ✓ FOR ANY TYPE OF WALL
- ✓ ONE-SCREW ADJUSTMENT
- ✓ ANCHORS SECURELY

The RACO Griptite Box takes less time to install, is easier to adjust, holds tighter than any other method of "old-work" installation. Made of heavy gauge metal . . . durably finished. Saves time and money . . . helps protect your profit margin on "hard-to-figure" old work installations.

WRITE TODAY FOR COMPLETE INFORMATION

"A RACO BOX FOR EVERY NEED"

ALL-STEEL EQUIPMENT INC. Aurora, Illinois

Any way you look at it...

INSULATING'S EASIER WITH

REG. U.S. PAT. OFF.

SCOTCH BRAND ELECTRICAL PRODUCTS!

That's *right*—insulating's easier, cleaner, less expensive with "Scotch" Brand Electrical Products. Modern materials and methods are working for you. Figure it out for yourself: any workman of average skill can turn out expert results with "Scotch" Electrical Products—in less time than an expert would take with old-fashioned insulating materials. Want to know how many different ways you can save with "Scotch" Brand? Just drop a card to 3M, Dept. CB-116,, St. Paul 6, Minnesota. Do it today!

"SCOTCH" BRAND PLASTIC ELECTRICAL TAPE NO. 33 is one of the "Scotch" Brand Plastic Electrical Tapes with tough vinyl backings. No. 33 is super-thin, yet does the job of two ordinary insulating tapes.

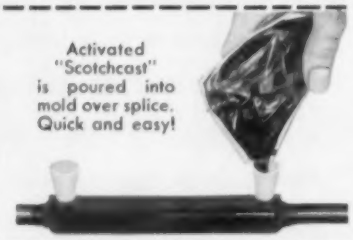
"SCOTCHLOK" BRAND ELECTRICAL SPRING CONNECTORS are the tightest-gripping wire connectors on the market! Spring tension grips tight, can't shake loose. Just twist on, snap off winding stem and the splice is made!

Neat and compact splices are easy with "Scotch" 33 and "Scotchlok."

"SCOTCHFIL" BRAND ELECTRICAL INSULATING PUTTY comes in a roll, applies like tape. It's the easy way to fill voids and pad sharp edges on cable connectors, motor terminals and bus bars. Will not corrode copper.

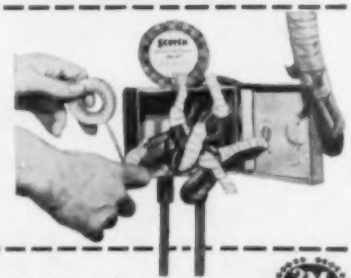
"Scotchfil" gives extra-heavy protection to splice made with "Scotchlok."

"SCOTCHCAST" EPOXY RESINS cure quickly into a solid, moisture-resistant insulation with maximum protection against mechanical and electrical stresses. Now in "UNIPAK" container for field application in splicing kits.



Activated "Scotchcast" is poured into mold over splice. Quick and easy!

"SCOTCH" BRAND ELECTRICAL INSULATING TAPE NO. 27 is a glass-cloth tape with true thermosetting adhesive. High-heat operating conditions actually cure adhesive to form a permanent bond of great strength. Never rots or shrinks.

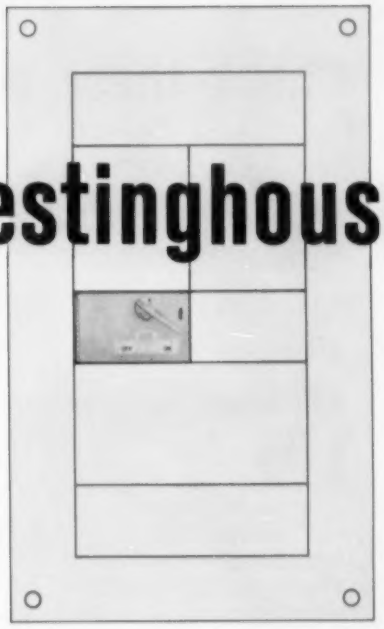


PRODUCT OF 3M RESEARCH

The term "Scotch" is a registered trademark of Minnesota Mining and Manufacturing Company, St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N. Y. In Canada: P.O. Box 757, London, Ontario.

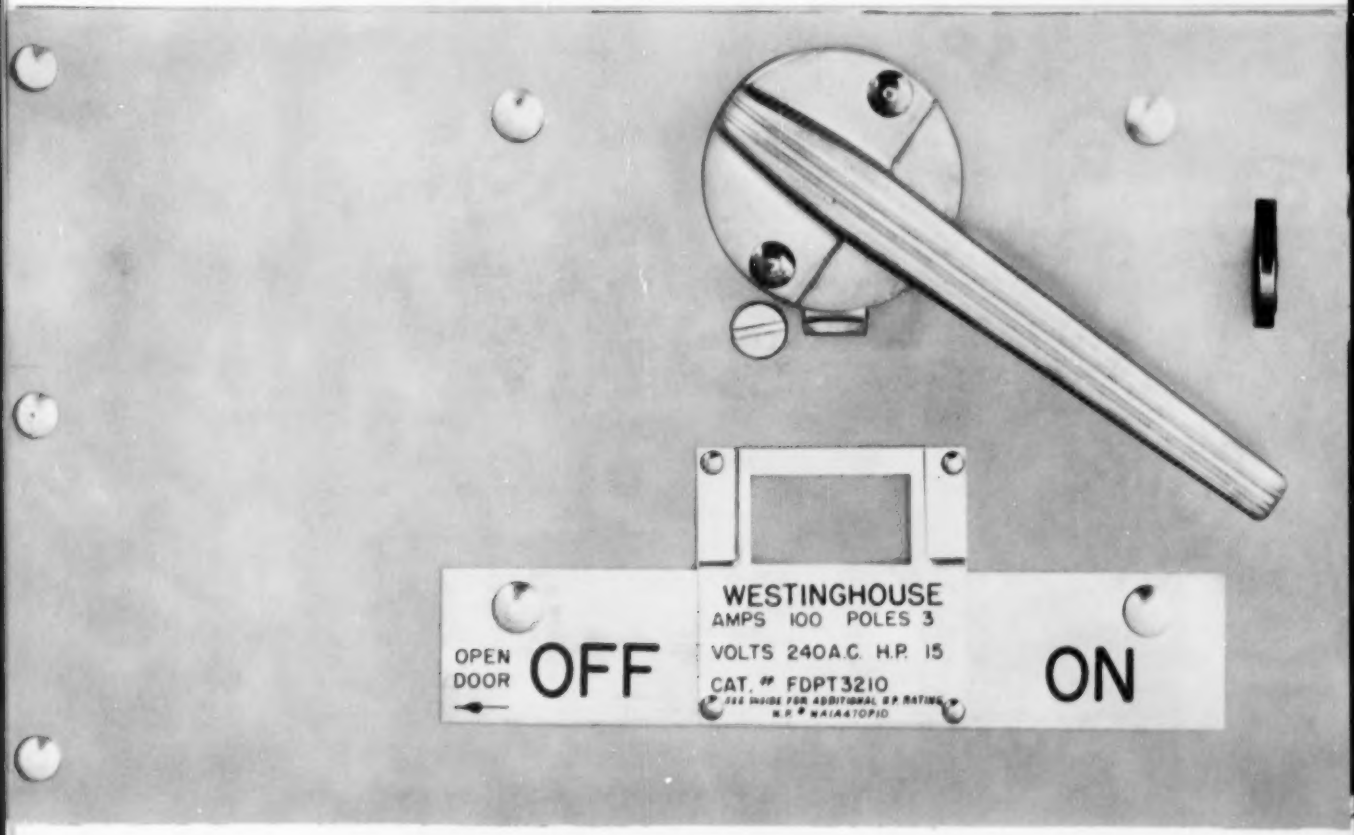
3M COMPANY

NEW from Westinghouse



Industry's First De-ion® Fusible Distribution Panelboard

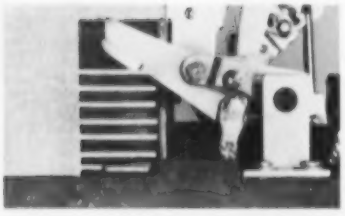
...the *Life-Line FDP*

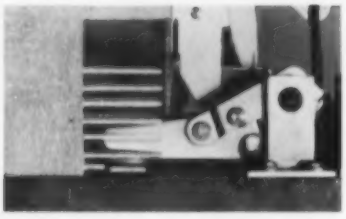


YOU CAN BE **SURE**... IF IT'S Westinghouse

A panelboard equipped to meet your most demanding requirements

. . . Because It Has a Switching Mechanism That Incorporates . . .





Quick-make, quick-break

You get fast, safe action. The switch in the new Life-Line FDP uses an over-center, spring-operated toggle device with a sturdy crossbar to completely eliminate the possibility of teasing.

De-ion arc quenchers

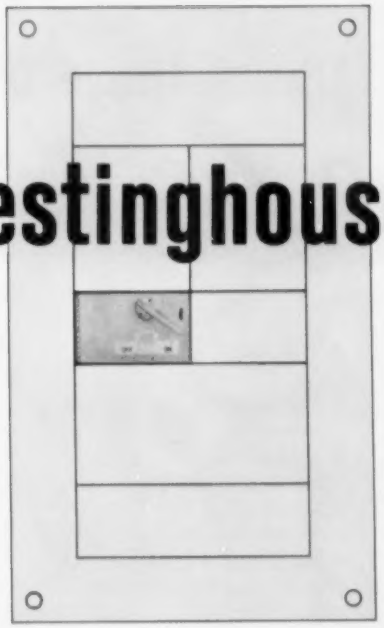
The exclusive Westinghouse principle of arc extinction provides a fast, positive method of breaking hot arcs. De-ion grids confine, divide, and extinguish arcs quickly and safely.

Visible blades

Positive indication of whether contacts are in open or closed position. You see the switch blades at a glance—no guesswork.

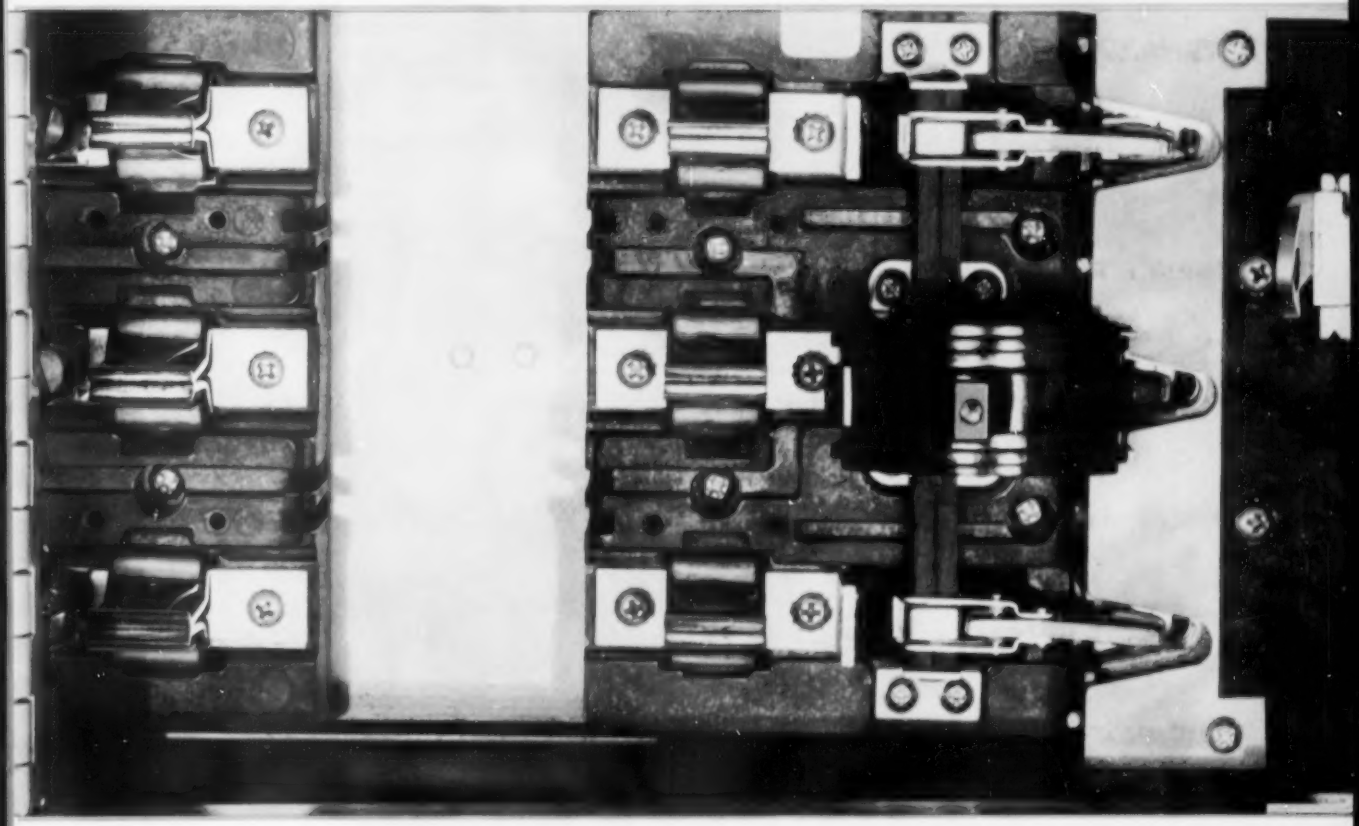
The only fusible distribution panelboard that combines these three outstanding advantages...

NEW from Westinghouse



Industry's First De-ion® Fusible Distribution Panelboard

...the *Life-Line FDP*



YOU CAN BE **SURE**... IF IT'S Westinghouse

Check these advantages of the new

Life-Line FDP PANELBOARD...

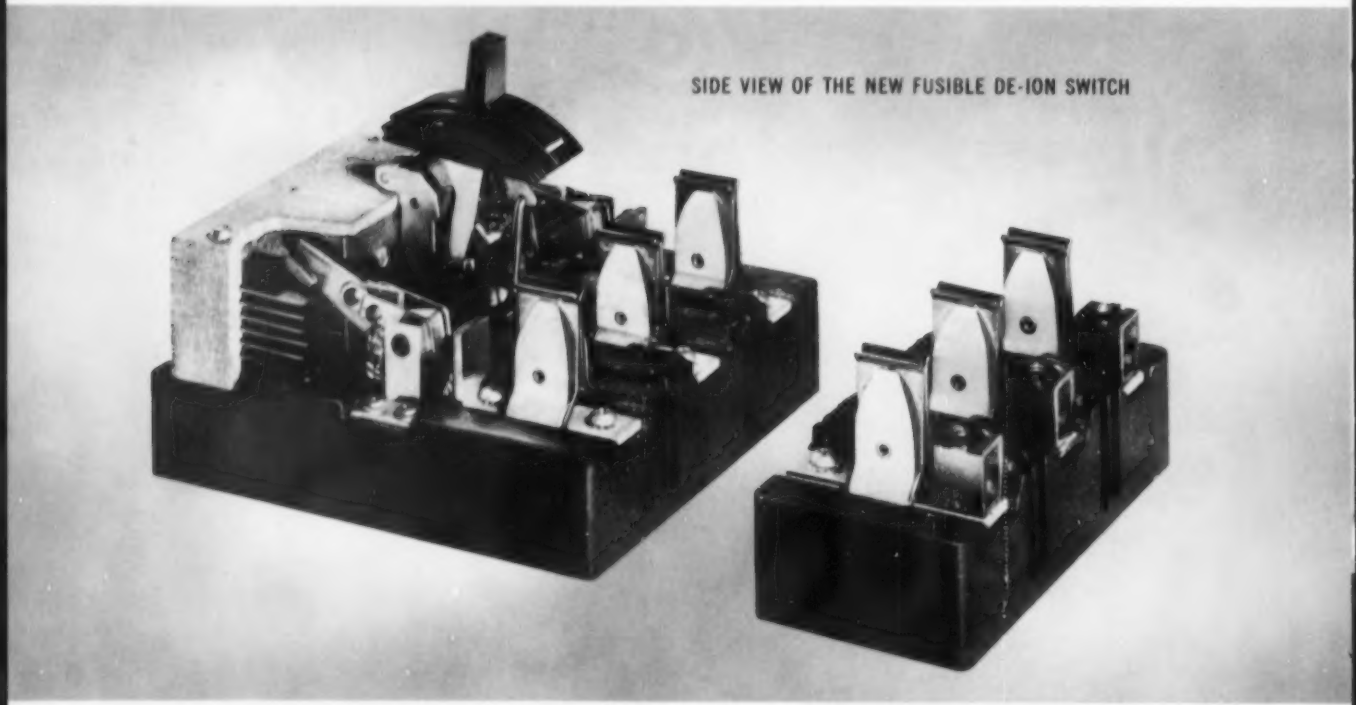
in the switch . . .

- Quick-make, quick-break switching mechanism
- Visible blades
- Switching mechanism provided with De-ion principle of arc extinction
- Silver-alloy switching contacts
- Solderless connectors
- Reinforced fuse clips
- Externally operated handle for each switch
- Horsepower rated switches
- Provision for locking switches in "on" or "off" position
- Provision for circuit identification at each switch
- Access door over fuse compartment interlocked for safety

DOUBLE-DOOR UNIT

in the panelboard . . .

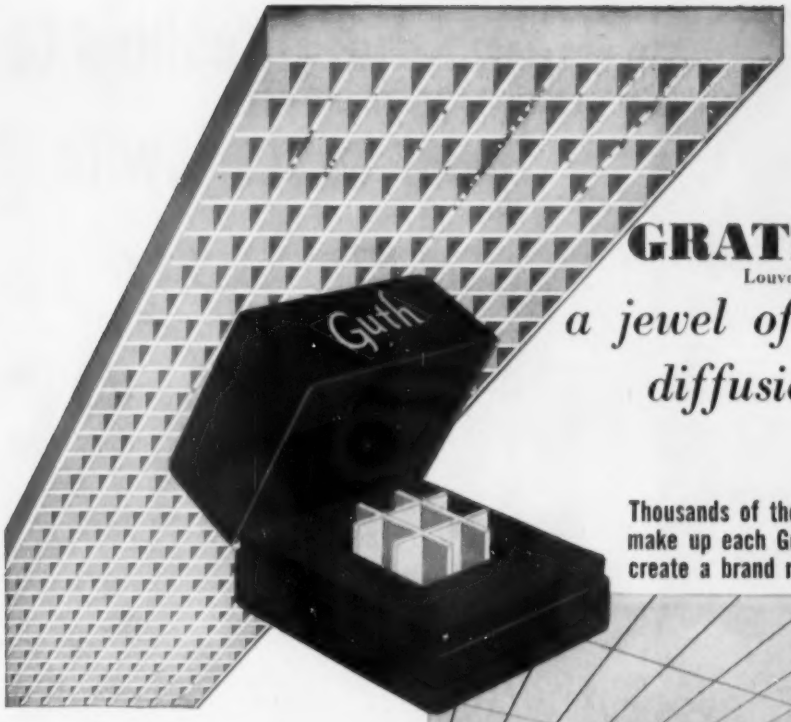
- Ample wiring and gutter space
- Space for future units can be provided
- Suitable for wall mounting
- Standardized enclosures
- Maximum convertibility
- Extended neutral bar



SIDE VIEW OF THE NEW FUSIBLE DE-ION SWITCH

YOU CAN BE SURE...IF IT'S Westinghouse

J-93529



GRATELITE...

Louver-Diffuser

a jewel of sight-saving diffusion power

Thousands of these cubes make up each GrateLite panel... and create a brand new kind of light.

FINE DIFFUSION... the cubicles appear to blend into one solid, luminous mass. Its surface is 30% vertical members!

HIGH EFFICIENCY...translucency and openness, tapered vanes, shallowness (3/8") —these assure highest illumination values with low absorption factor.

LOW BRIGHTNESS ...its vanes with contrasting cubicles and "in shadow" characteristics render light of extremely low brightness without an effect of dimness.

EXCELLENT SHIELDING . . . exclusive 45° x 45° shielding method (with 3/8" cubes) gives greater eye protection than any other louver with larger openings.

LOW MAINTENANCE . . . GrateLite *stays* clean—bugs and dust drop right through. Quick, easy washing restores brand new luster every time. A two minute job!

AND MORE! GrateLite's closely spaced vanes make it rugged to stand severe usage. It provides efficient AIR CONDITIONING DIFFUSION... and filters out a portion of room noise.

It's all in the sight-saving cubes—and only GrateLite has them!

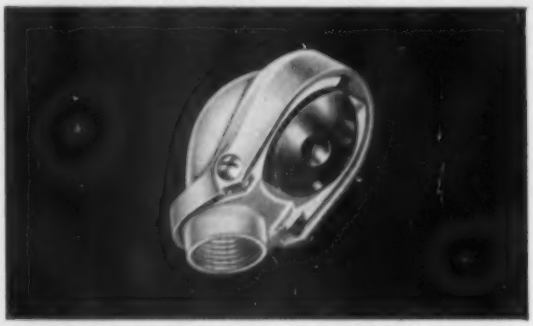
Write for free booklet "The GrateLite Story" today.

THE EDWIN F. GUTH COMPANY ST. LOUIS 3, MO.

Leaders in Lighting since 1902

*℗ U.S. Pat. No. 2,745,001
Can. Pat. Pend.

"SPECIAL" ENTRANCE CAP for S.E. cables. With 5-hole insulator. Many inspection authorities require the use of special cables to meet particular requirements such as looking down a yard pole to meter box with a 5-conductor cable. Gedney, accordingly, designed this special entrance cap. Malleable iron; hot dip galvanized.



THREADED CONDUIT ENTRANCE CAPS Like most other Gedney entrance caps, this one is made of malleable iron to prevent breakage . . . hot dip galvanized for maximum service life. Sizes range from ½" to 6".

ENTRANCE CAPS for S.E. Cables—with key hole mounting bracket. Easy to assemble—cable slips into cap and is securely held by clamping shoe. Has split insulator and well bushed holes. Overlapping cover protects cables from weather. Malleable iron, hot dip galvanized.

Cross the threshold to lower costs...with

GEDNEY ENTRANCE CAPS

Malleable Iron–Hot Dip Galvanized

THESE ENTRANCE CAPS install faster—and cut your *final* costs right down to rock bottom. Like all Gedney Fittings they're accurately machined and threaded...smooth finished, with no burrs or metal particles. On top of that, the Gedney line includes many improved design features that bring extra efficiency and labor savings. For fittings that bring today's lowest installed cost, specify Gedney!

GEDNEY FITTINGS FIT

GEDNEY
ELECTRIC COMPANY

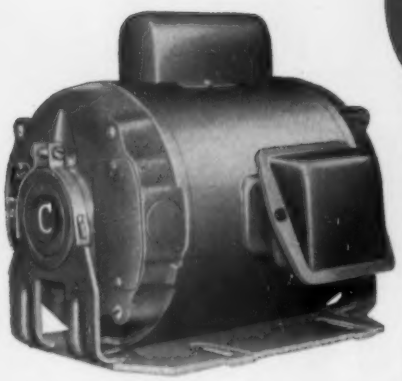
RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

Your choice of normal or low starting current...

with Performance-Rated

Century

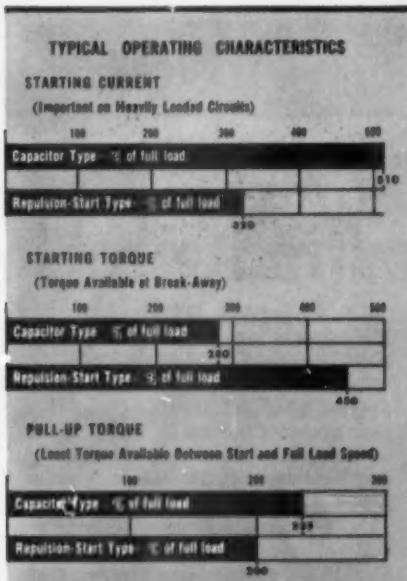
HIGH TORQUE, SINGLE-PHASE MOTORS

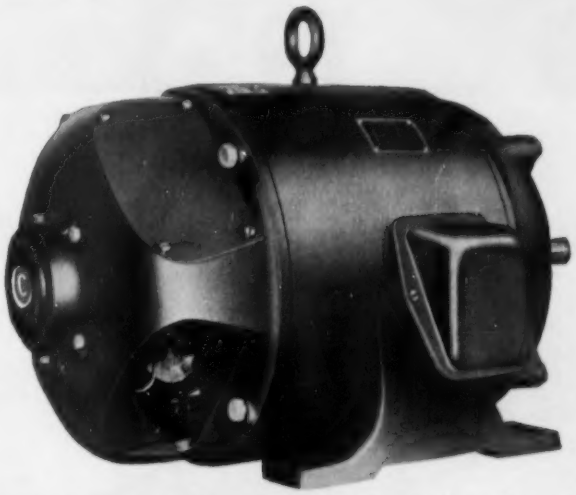


Capacitor Motors... ⅛ to 20 H.P. provide high starting torque, high pull-up torque and require normal starting current. They are available in drip proof, dust proof and explosion proof enclosures.

Even if you have severe starting current limitations, you can select the torque you need for sure starts and smooth pull-up to speed from the Century Performance-Rated Single-Phase line (see bar chart below for operating characteristics of two types of Century Single-Phase Motors).

Whatever Your Motor Job . . . there's a Century Motor Performance-Rated to handle it with top effectiveness. Contact your nearby Century branch office or Authorized Distributor.





Repulsion Start, Induction Motors (type RS)... ½ to 7½ H.P. provide very high starting torque, yet require unusually low starting current. They are available in drip proof and splash proof enclosures.

Performance-Rated®
Motors
⅛ to 400 H.P.

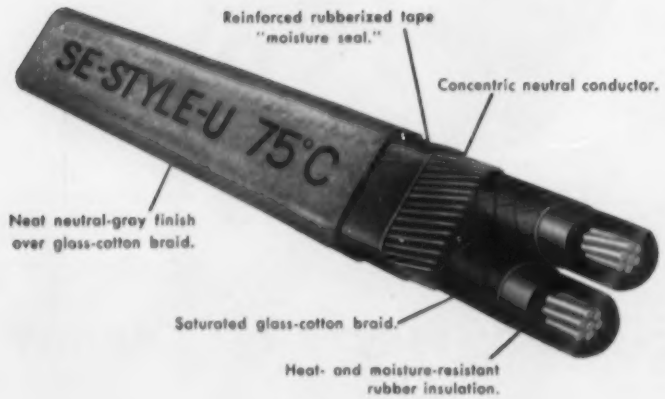
CENTURY ELECTRIC COMPANY

CE-32

1806 Pine Street, St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*

Neither heat nor rain will damage this installation of Rome Service Entrance cable. Easy to work, the cable permits neat installations.

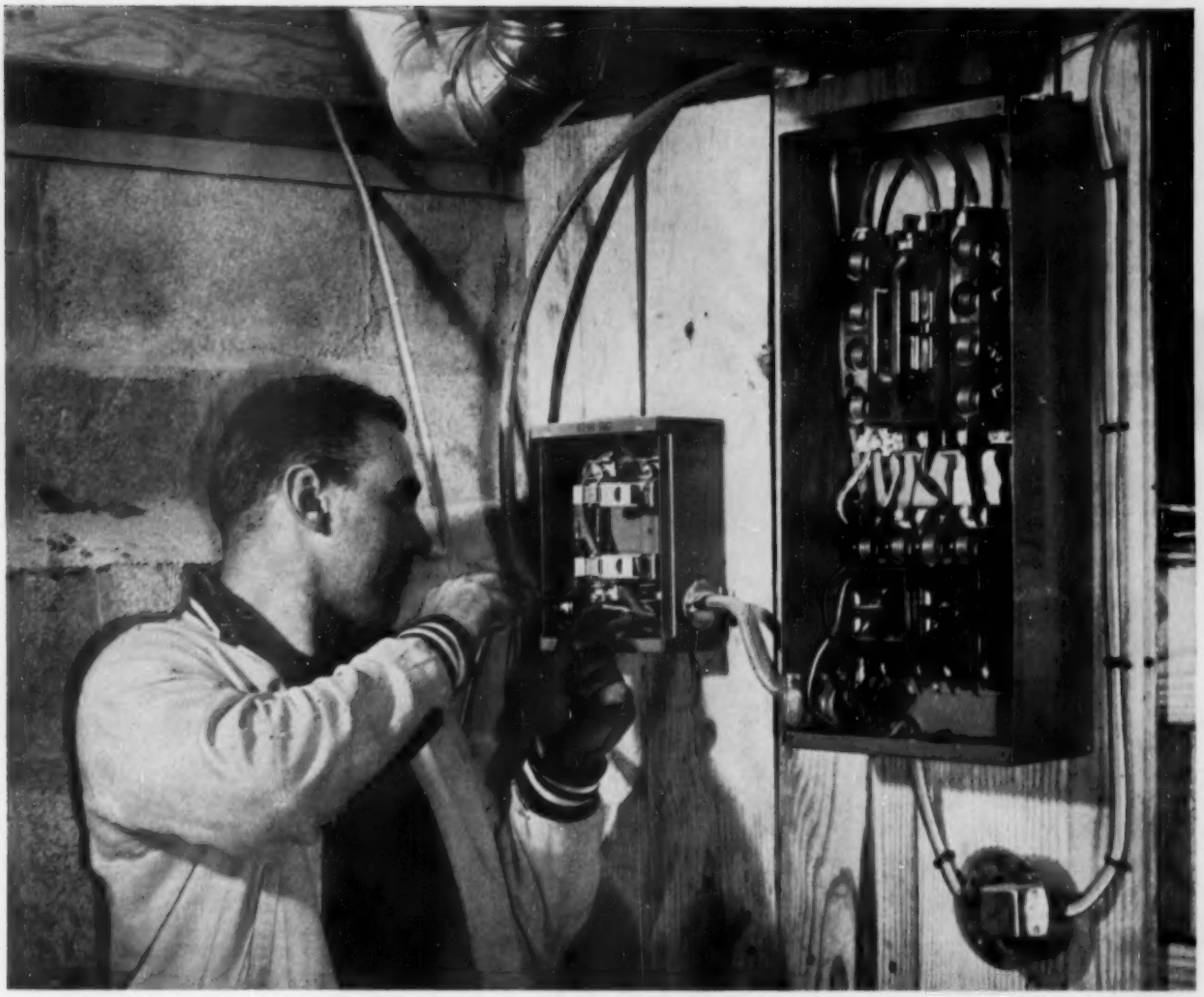
New Rome service entrance cable


Reinforced rubberized tape "moisture seal."
Concentric neutral conductor.
SE-STYLE-U 75°C
Neat neutral-grey finish over glass-cotton braid.
Saturated glass-cotton braid.
Heat- and moisture-resistant rubber insulation.

Rome's new and improved Type SE service entrance cable is the ideal selection for new and re-wired 100 ampere service. It fully meets all the requirements for a service entrance cable that can handle all the electric appliances and air conditioning needs of modern living.

In addition, this versatile cable may enable you to reduce warehouse inventory levels and the amount of cable carried in your service trucks. The same cable can be used:

1. From pole to meter
2. From service drop to meter
3. And from meter to electric range, washing machine, clothes dryer, hot water heater, etc.



Rome Type SE service entrance cable can be used: 1. From pole to meter; 2. From service drop to meter; 3. From meter to electric range, etc.

designed for modern 100 ampere service

Other features of Rome's Type SE cable include:

1. The outer glass-cotton braid is finished to give the cable a neat appearance without sacrificing flame and moisture resistance. This neutral gray finish can be painted, if desired, to match the color of the building on which the cable is installed. It withstands severe storage and service conditions without deteriorating and becoming tacky.
2. The glass-cotton braid on each conductor—one red and one black—is clean, permanent, and provides easy conductor identification. For easy and positive exterior identification, the outside of the cable is surface printed "SE-Style U 75°C."
3. Underwriters' approved for 75°C. operation in *either dry or wet* locations. A reinforced rubberized tape under the weather-resistant outer braid puts the assembled conductors in a "dry location." In addition, the moisture seal provides added protection against cutting by clamps and other fittings, increasing service life.
4. In three conductor construction for 100 ampere service, Underwriters' approval makes possible the use of size 3 AWG copper conductors, or two conductors of size 3 AWG with a neutral conductor of size 5 AWG.

Specify Rome service entrance cable for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 365-A and ask for Bulletin SE-1. Rome Cable Corporation, Rome, N. Y.

ROME CABLE

CORPORATION

John Severin (right) talks over plans for a new tract with Ray Nicholson of The Pacific Telephone and Telegraph Company.

"Our salesmen stress concealed telephone wiring"

— says Mr. John S. Severin of Severin Construction Company, San Diego, Cal.

"Concealed telephone wiring has become a competitive sales feature," says Mr. Severin. "More and more home buyers are asking for it. Our salesmen stress concealed wiring when talking to potential customers, and we play it up in our radio, TV and newspaper advertising.

"It's easy to understand why people want concealed telephone wiring. It preserves the inside beauty of a house, and it's in line with the modern trend towards built-in convenience. To me, concealed telephone wiring is one sign of a well planned and constructed house."

In thirty years as builders, Mr. Severin and his brother Nels have built nearly 6000 homes, with hundreds more under construction at the moment. They are members of the N.A.H.B., the B.C.A. and many other professional organizations. In company with trend-minded builders across the country, they are convinced of the value of concealed telephone wiring as a quality sales feature.

• • •

Your nearest Bell Telephone business office will help you with concealed wiring plans. For details on home telephone wiring, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

BELL TELEPHONE SYSTEM

Fixtures for the new National Housing Center, Washington, D.C., by Smithcraft Lighting Division, Chelsea, Massachusetts. LUCITE molded by Mack Molding Company, Arlington, Vermont. Architects: Aubinoe, Edwards and Beery, Washington, D.C. Lighting designed by Kluckhuhn, Cobb and McDavid, Washington, D.C. Electrical contractor: Walter Truland Company, Arlington, Va.

There are 391 fixtures, using 1,564 square feet of LUCITE, illuminating about 30% of the total floor space in the building. The LUCITE is installed in a single frame of steel hinged to the fixture. The Housing Center has an average of 45 foot-candles, as opposed to the 30 foot-candles usually found in office buildings.

Better looking, better lighting

with fixtures of Du Pont LUCITE®

The National Housing Center, in the heart of the nation's capital, is the show place of the home-building industry and the headquarters of the National Association of Home Builders. The eight-story, $2,500,000 building serves as a storehouse of accumulated knowledge on home building and related matters and a focal point for all major housing activities. Contributing to the beauty and efficiency of this modern architectural center are lighting fixtures made of LUCITE acrylic resin.

Fixtures of LUCITE are used on three floors, containing the offices, library, conference rooms and work areas. Because they are made of Du Pont LUCITE, these fixtures transmit optimum light without specular glare or shadow. They are strong, durable, free from discoloration and dimensionally stable. Installation is a simple matter.

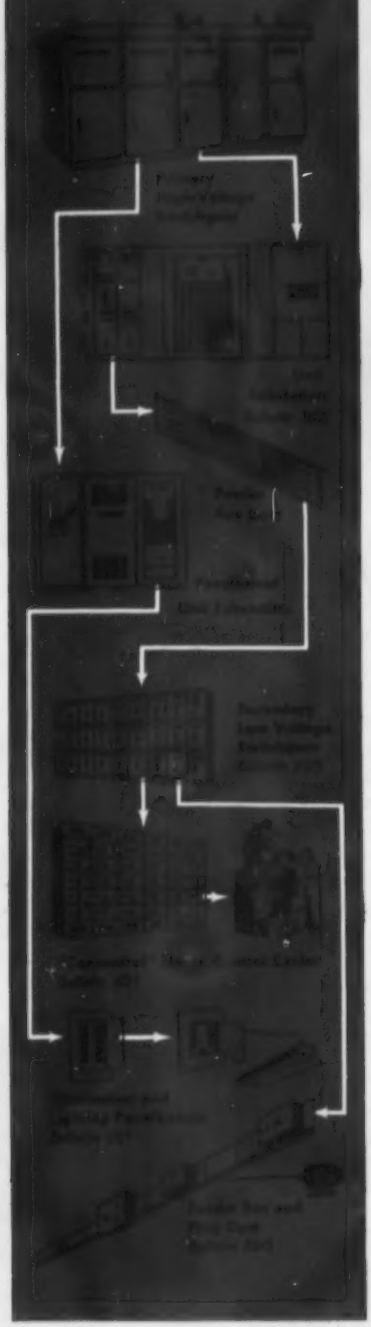
SEND FOR FREE, NEW BOOKLET. This new 12-page illustrated booklet describes all the latest property and application data on LUCITE acrylic resin for lighting. For your free copy, write to E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 4411, Du Pont Building, Wilmington 98, Delaware.

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

PATH of POWER through CONTINENTAL EQUIPMENT



Double-ended Unit Substation

adaptable . . . reliable . . . safe . . .

UNIT SUBSTATIONS

Unit Substation with Dry Type Transformer

Panelboard Unit Substation

Assure Production Continuity at the Most Economical Power Cost

CONTINENTAL Unit Substations incorporate equipment protection based on system requirements. Engineered as self-contained power centers, they offer guaranteed quality and craftsmanship. Production goes up . . . maintenance worries and power costs come down! Delivered complete, they can be readily expanded or relocated for maximum efficiency.

- broad selection of primary equipment to fit installation requirements
- 4 standard types of transformers
  - —self-cooled dry type
  - —sealed dry type
  - —non-inflammable liquid type
  - —oil filled type
- complete choice of secondary equipment to suit operational demands

SHIPMENT: 8 WEEKS*

Compare for yourself. Write for detailed specifications today.

CONTINENTAL ELECTRIC EQUIPMENT CO.

General Offices: 204 West 4th St., Cincinnati 2, Ohio

Manufacturing Plants in Ludlow, Ky. and Tampa, Fla. Sales Engineering Offices in all Principal Cities
EXPORT DEPT.: N. American Philips Co., Inc., 100 E. 42nd St., New York 17, N. Y.

*BASED ON RECEIPT OF COMPLETE REQUIREMENTS. IF APPROVAL DRAWINGS ARE REQUIRED, ADD 2 WEEKS

The standard for splicing economy

GOLD SEAL RUBBER TAPE

For top value . . . in any type . . . get

JENKINS *Gold Seal Tape*

FRICTION • RUBBER • PLASTIC

BEST BUY FOR PLANT SUPPLY

All types of **GOLD SEAL TAPE** are packed in 10-roll cartons as well as single rolls. Every roll cellophane-protected, stays fresh. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17. **DIAMOND SEAL** Friction and Rubber Tape are also made by Jenkins Bros. to ASTM specifications.

for maximum PROTECTION AGAINST SHORT CIRCUITS or OVERLOADS

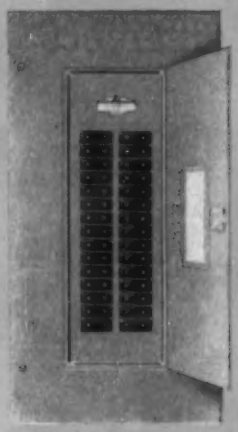
FA

circuit breaker type

PANELBOARDS

circuit breaker features

1. Calibration Screw
2. Bi-Metal Thermal Element
3. Current Flow Path
4. Load Terminal
5. Magnet Spring Cushion
6. Hi-Current Magnets
7. Flexible Current Carrying Pig-Tail
8. Cold Cathode Arc Cooling Chamber
9. Cooling Fins
10. Line Side Plug on Contact
11. Electro-Welded Non-Freezing Contacts
12. Tumbling Contact Lever
13. Quick Make and Quick Break Spring
14. Safety Kick Lever
15. Operating Handle



QP QUICKLAG P

A plug-in thermal-magnetic type featuring QP Quicklag P., Circuit breakers. Screwless assembly (just slip the breakers in) one pressure type of connection between circuit breaker and bus bar and sequence bussing to balance the load to permit double pole individual trip combinations and single pole circuit breakers with common trip are other features. Panel is compact and has standard knockouts at top and bottom.

QS QUICKLAG S

A thermal-magnetic Circuit breaker type with screw connection to bus bar. Features QS Quicklag S Circuit Breckers, sequence bussing to balance the load to permit double pole individual trip combinations and single pole circuit breakers with common trip. Furnished in standardized cabinets with standard knockouts, top and bottom.

Install these safe, efficient panelboards on all lighting branch and other circuits where dependable automatic circuit protection is desired.

Approved by the Underwriters' Laboratories' Inc., these long-lasting, trouble-free panelboards provide positive protection against service interruptions caused by overloads and short circuits.

A feature of these panelboards is the trip-free handle of the circuit breaker which prevents contact from being held in closed position against overloads and short circuits. The inverse time limit prevents the circuit breaker from tripping on momentary overloads and quick break of contacts is provided when manually operated or automatically tripped.

Ⓕ Circuit Breaker Panelboards are of two types — the QP Quicklag P, and the QS Quicklag S. All are of the panel base assembly type which means that all components are available on Dealer's Shelves for quick and easy assembly on the job.

Boxes are of ten sizes — five with main lug connections and five with main circuit breaker connections, 50 to 225 amps., capacity. These, plus a stock of individually-packaged single and double pole circuit breakers will fit almost any job requirement. Circuit Breakers are interchangeable, so that it is as easy as changing a light bulb to make changes or add new units.

Circuit Breaker capacities are 10, 15, 20, 30, 40, 50 amps., 4 to 42 poles, 120/240 volts 3-wire single phase or 120/208 volts 4-wire three phase mains with lugs or main circuit breaker.

For complete information about these new and better panelboards consult your nearest Ⓕ representative listed in Sweets or see your nearest wholesaler.

FRANK ADAM *Electric Company*

BOX 357, MAIN P. O. • ST. LOUIS 3, MO. • Phone JEfferson 3-6550

makers of: *busduct • panelboards • switchboards • service equipment safety switches • load centers • Quikheter*

Lighting by DECIDEDLY BETTER DAY-BRITE Lighting Fixtures makes the big difference . . .

Mr. Wm. E. Ketler, Vice President, Blumenthal-Kahn Electric Company, Baltimore, Md.

"No wasted time with Day-Brite fixtures"

"There are a lot of things we like about Day-Brite fixtures. Just to mention one:

"Day-Brite fixtures come to us complete and ready to install. Everything's furnished—we don't waste valuable time looking around for missing parts or doing any recutting or rethreading.

"That lets us finish the job quickly and move on to the next. It all adds up to happy customers and a clean profit on the job."

Mr. Ketler knows what he's talking about, just like hundreds and hundreds of other contractors all over the country.

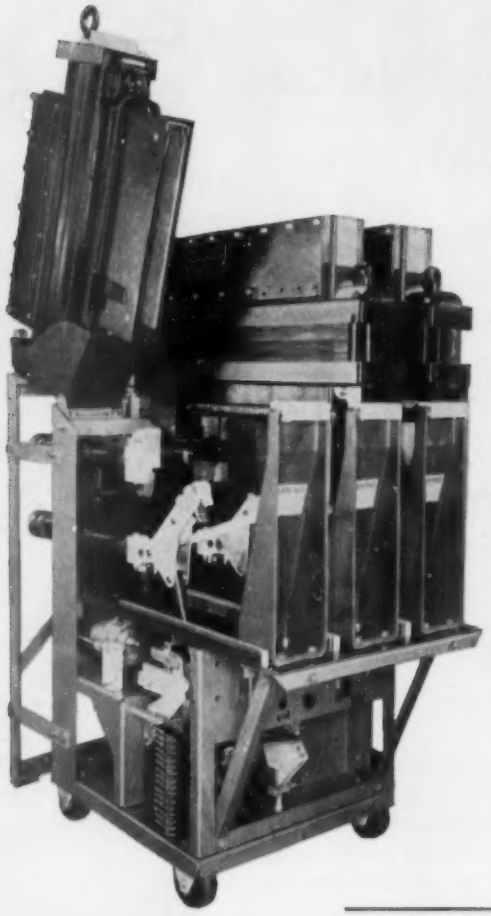
Certified Lighting for a Better America

61180

"DECIDEDLY BETTER" DAY-BRITE Lighting Fixtures

Day-Brite Lighting, Inc.
5402 Bulwer Avenue
St. Louis 7, Missouri

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT



A Complete Line of I-T-E Metal-Clad Circuit Breakers for Every Application

Anticipating the proposed addition of three new higher metal-clad switchgear ratings, I-T-E now has a complete line of circuit breakers which are fully developed and tested to meet every requirement.

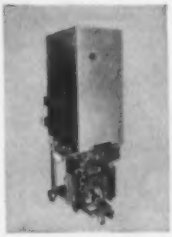
New 75 mva interrupting rating for I-T-E metal-clad switchgear applied on 4.16 kv systems

New 350 mva interrupting rating with a new 3000 amp continuous rating for application on 2.3 or 4.16 kv systems

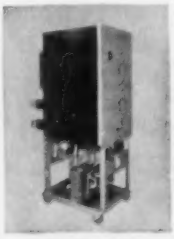
New 750 mva interrupting rating for application on 13.8 kv systems at 1200/2000 amp continuous

I-T-E Type	Continuous Amperes	Rated KV	Interrupting MVA
5HV-75	1200	4.16	75
5HV-150	600-1200-2000	4.16	150
5HV-250	1200-2000	4.16	250
5HV-350	1200-3000	4.16	350
7.5HV-250	1200-2000	7.2	250
7.5HV-500	1200-2000	7.2	500
15HV-150	600-1200	13.8	150
15HV-250	1200-2000	13.8	250
15HV-500	1200-2000	13.8	500
15HV-750	1200-2000	13.8	750

Note. These ratings require no change in I-T-E compartment dimensions.



5HV-75



5HV-350

15HV-750

For complete information, call your nearest I-T-E sales office. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

Now your local wholesaler can give you an immediate, FREE replacement for any

"defective-in-warranty" Sola fluorescent ballast!

If your regular electrical wholesaler stocks certified CBM ballasts for over-the-counter sale, he can give you an immediate, *free* replacement for any defective in-warranty Sola fluorescent ballast you bring in.

There's absolutely no cost to you, no delay, no red tape or obligation of any kind. Your regular local wholesaler is able to provide this free service through a special arrangement with Sola Electric Co. Even if he does not stock Sola ballasts, he can give you an *immediate* replacement. Sola has authorized him to give you an equivalent certified CBM ballast of another make if necessary!

Feel free to take advantage of this free service now offered by leading electrical wholesalers all over the country. Your customers will appreciate the fast replacement service you can now give them in those rare instances when a Sola ballast fails.

The quality standard of Sola ballasts

The Sola Ballast Service Plan is made possible because Sola ballasts have an exceedingly low failure ratio. Less than 14/100-of-1% of *all* Sola ballasts fail in-warranty, and less than 9/100-of-1% of Sola Rapid Start ballasts fail in-warranty. This very low failure ratio is due to Sola's policy of maintaining exceptionally high standards of quality in engineering and manufacturing.

Here's how the plan works

1. Should you find a Sola ballast which has failed within the warranty period, take it to the nearest electrical wholesaler who is a qualified Ballast Service Center. Most likely this will be your regular wholesaler if he stocks certified CBM ballasts for over-the-counter sale. He will check the warranty date stamped on the ballast cover.

UL

CBM CERTIFIED by UL

2. If the ballast failed within two years of this warranty date, your wholesaler will replace it *free*, with another Sola ballast if he stocks them. If not, he refers to a replacement guide provided by Sola, to find an equivalent certified CBM ballast of another make which he stocks.

3. Your wholesaler will immediately give you a new Sola ballast or the equivalent certified CBM ballast replacement. There is absolutely no charge to you, no red tape, no delay. You merely sign a receipt and take the replacement ballast with you.

4. Because the replacement was made through your local wholesaler, no time was lost in ordering or waiting for delivery. Your customer appreciates the fast service you are able to give him in restoring his fixture to perfect operating order.

FREE Sola Cross Index Ballast Replacement Guide from your local electrical wholesaler

Most likely, your regular local electrical wholesaler is participating in Sola's Ballast Service Plan, even though he does not stock Sola ballasts. If he stocks certified CBM ballasts of any make for over-the-counter sale, he can participate in the plan. He will display a Sola "Ballast Service Center" emblem in his place of business.

Ask him for a Sola Cross Index Ballast Replacement Guide. This valuable chart lists Sola ballasts and certified CBM equivalents. It also shows you how to determine if a Sola ballast is in-warranty. The chart folds to 8½" x 11", and is pre-punched to fit your standard 3-ring notebook. If your local wholesaler has none of these charts on hand, remind him that he can get a free supply from Sola Electric Co. for distribution to his customers. If you prefer, you can get your Replacement Guide by filling out and mailing the coupon below.

SOLA
Electric Co
4633 W. 16th St.
Chicago 50, Ill.
Bishop 2-1414

TO: SOLA ELECTRIC CO.
4633 West 16th St., Chicago 50, Ill.

Please send me, without any cost or obligation, the "Sola Cross Index Ballast Replacement Guide."

My name_____

Company_____

Address_____

City_____ Zone____ State_____

My Regular Wholesaler:_____
(Wholesaler's Name)

_____
(Wholesaler's Address)

GARCY

5600 Series Recessed Luminaire

with one-piece plastic shield

Weigh it

against other Large-Area Luminaires

Compare this plastic panel with the shielding on other 4 ft. by 4 ft. fixtures. Where the conventional flat panel sags of its own weight, Garcy's die-formed contour gives lasting stability...permits lighter weight and reduced ceiling load. Installation, cleaning and relamping go more quickly. The panel swings down easily in its hinged frame, puts no strain on the fixture or the worker.

Compare it also for beauty, durability, efficiency. When the fixture is lighted, the contour is hardly noticeable, lending an unobtrusive but interesting "character" to the ceiling treatment. The light is evenly diffused and efficiently transmitted. For the luxury look in lighting, choose Garcy's 5600 Series.

Available in the following sizes: 4′ x 4′; 2′ x 2′; 2′ x 4′; 2′ x 8′. Also available with Alba-Lite glass or louver shields.

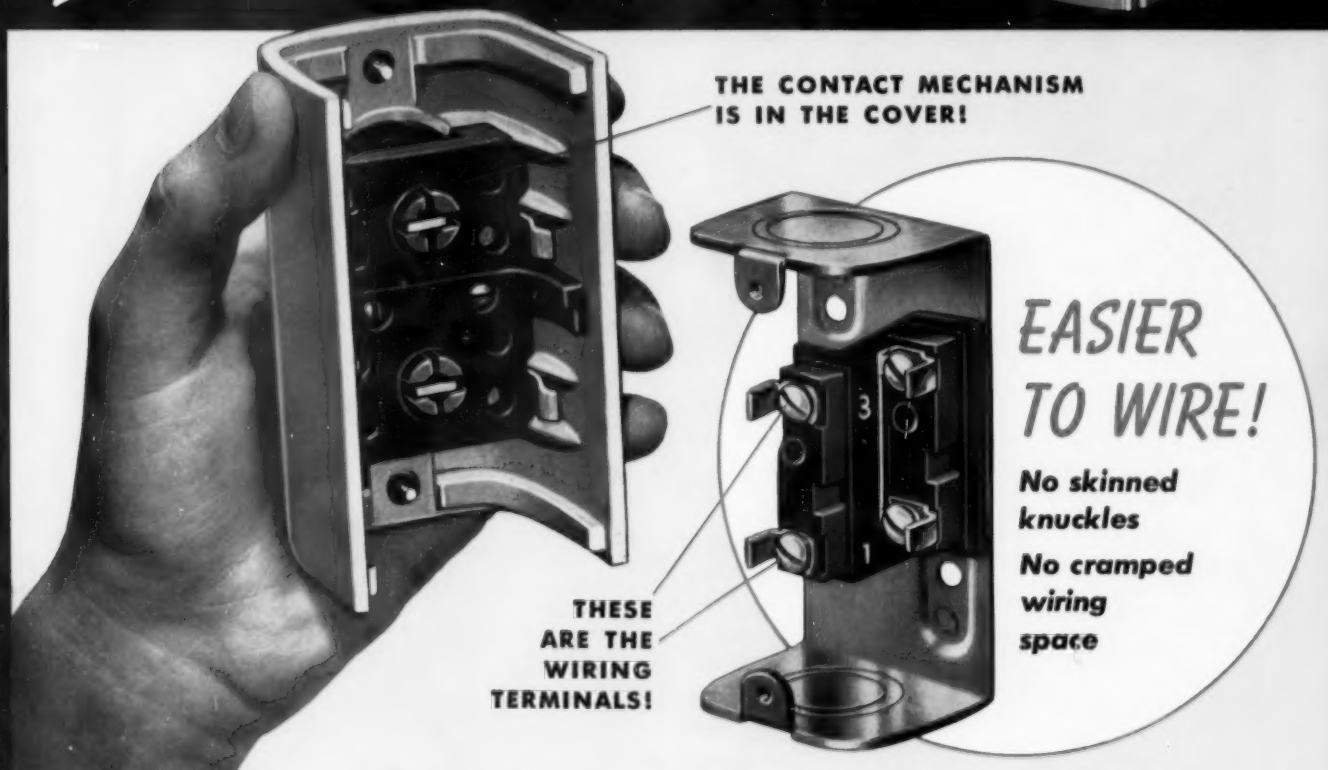
Send for Bulletin 552-L

GARCY **Quality by *Design***

Garden City Plating & Mfg. Co., 1730 N. Ashland Ave., Chicago 22, Illinois

In Canada: Garcy Co. of Canada, Ltd., 1244 Dufferin Street, Toronto 4

Brand New Idea in STANDARD-DUTY STATIONS



EASIER TO WIRE!

No skinned knuckles

No cramped wiring space

Here's an entirely new idea in push button stations—a wrap-around cover—with the contact mechanism part of the cover. Removing the cover exposes the terminals for instant and easy wiring. Strong, spring type, silver plated contacts connect the push button assembly in the cover with the terminals in the base.

Matching ribs in the cover and notches in the terminal blocks assure that the wiring connections are always correctly made. A bakelite shield protects the contact mechanism and prevents careless wiring from interfering with the contact operation. Concentric knockouts are provided in both top and bottom of the heavy metal base.

You will want to know about this new standard-duty station because—it is good looking—it takes less time to install—it was designed for the convenience of the installation engineer.

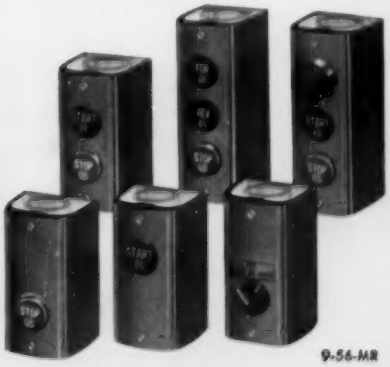
Let us show you a sample of this "brand new idea" in standard-duty stations!

A-B Quality

ALLEN-BRADLEY

MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ontario



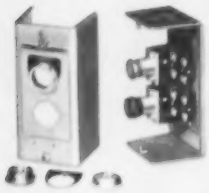
Bulletin 800 standard-duty push button stations can be supplied with one, two, or three buttons, or as a selector switch. Also available with pilot light. Furnished only in NEMA Type 1 enclosures.

9-56-MR

Also... NEW HEAVY-DUTY PUSH BUTTONS

BULLETIN 800

NEW FLEXIBILITY!



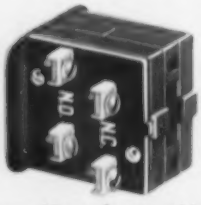
You can assemble any special heavy-duty station from a small stock of standard push button, selector switch, and pilot light components. There is no need to wait for long delivery of your special stations.

Stations can be arranged for either vertical or horizontal mounting. Name plates can be rotated to any position, replaced with any standard marking, or removed entirely.

NEW ENCLOSURES!

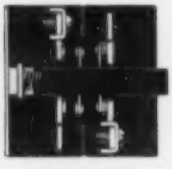
Each button, selector switch, or pilot light is a self-contained unit which can be mounted in attractive new enclosures. Standard enclosures accommodate up to eight units, but enclosures can be furnished for larger numbers.

NEW CONTACT BLOCK!



Above: View of contact block, showing terminals for normally open and normally closed contacts. Right: Contact block, with cover removed, showing stationary silver alloy contacts and pushrod carrying the moving contacts.

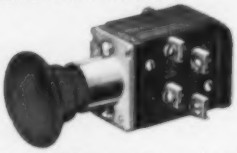
Bulletin 800 heavy-duty push buttons have the same molded contact blocks that have proved so dependable in Bulletin 800T oiltight push buttons, although they are not themselves oiltight. And all of them are equipped with double break, silver alloy contacts.



NEW OPERATORS!

Operators, which mount on the contact block, are available in many types, and push buttons come in various colors.

Type AK2B flush head START button



Type DK6A mushroom head button

Type PK16 pilot light with transformer

Type EK11B cylinder lock unit

9-56-MR

A-B Quality

ALLEN-BRADLEY

QUALITY MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. In Canada—Allen-Bradley Canada Ltd., Galt, Ontario

HEAVY DUTY Permacel Plastic Electrical Tape is excellent for all jobs requiring high dielectric strength and good conformability. Will not support combustion and is ozone-resistant. Here, used as a bus bar covering, Permacel 30 is superior for all types of electrical insulating, splicing and protecting.

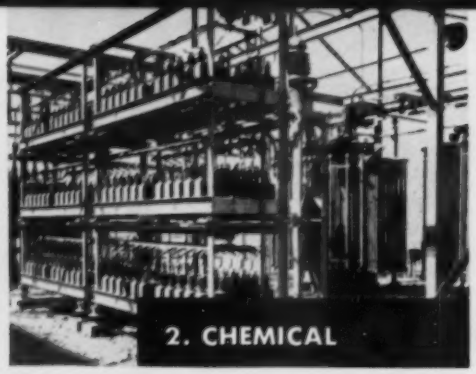
SELF-STICKING

PERMACEL® TAPE

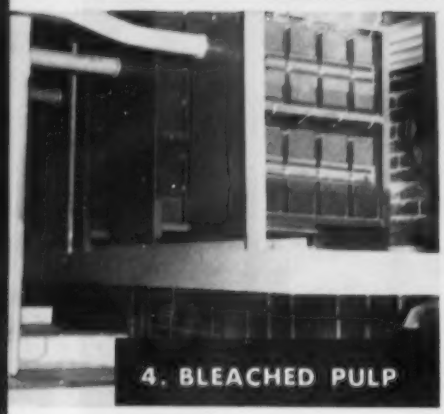
From Permacel Research . . . the right tape for any job. Write Permacel Tape Corporation, New Brunswick, N. J.

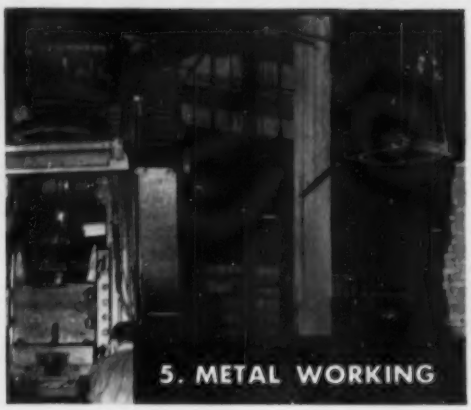
a Johnson & Johnson company

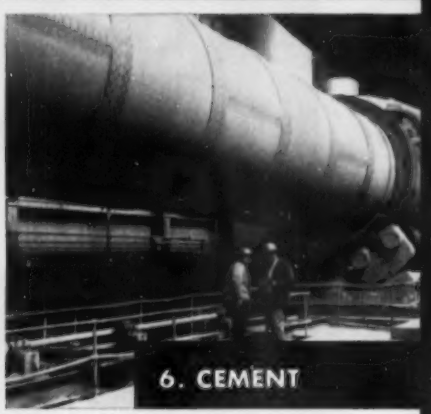
1. STEEL


2. CHEMICAL

3. TEXTILE


4. BLEACHED PULP


5. METAL WORKING


6. CEMENT

HERE'S HOW GENERAL ELECTRIC CAPACITORS ARE PAYING DIVIDENDS FOR SIX INDUSTRIALS

Here are the stories of six manufacturers who are now realizing high return on investment in terms of dollar savings, increased circuit capacity and better plant operating conditions by installing G-E industrial capacitors.

1. *Atlantic Steel Company, Atlanta, Georgia,* converted from line shaft drives to individual motor drives on its nail-making machines. Installation of 45 G-E 4-kvar capacitors at the motors helped make changeover possible by removing power factor problems arising from high motor starting torque.

2. *Shea Chemical Corporation, Columbia, Tennessee,* purchases its power on the basis of kilowatt demand with a sliding price scale for amounts over 29,000 kw. Installation of G-E capacitors helped raise power factor to 93.4%—saving Shea approximately $1250 a month in electric utility demand charges.

3. *Pepperell Manufacturing Company, Lindale, Georgia,* now saves an estimated $15,000 a year in power costs. General Electric capacitors helped raise Pepperell's plant power factor from 75% to better than 97%, enabling its utility to grant a lower rate.

4. *Riegel Paper Corporation, Carolina Division, Acme, North Carolina,* released an additional 1875 kw capacity by raising plant power factor from 82% to 95% with G-E industrial capacitors. Other benefits for Riegel were relief of overloaded load centers and postponement of the need to buy additional distribution and generating equipment.

5. *Empire Plow Company, Cleveland, Ohio,* paid off its capacitor investment of $1907 in just eight months, out of *power bill savings.* After 240 kvar of capacitors were installed, power factor rose to better than 97%. Improvement in power factor meant real savings in power bills.

6. *Peerless Cement Company, Detroit, Michigan,* needed additional power from its generating equipment because expanded facilities called for increased motor load throughout the plant. Installation of G-E capacitors raised power factor from 92% to 96%, allowing present generating facilities to handle the growing motor load and increasing the carrying capacity of previously overloaded feeders.

No matter where you are, no matter what you manufacture, General Electric capacitors may be able to give you dollar savings, increased system capacity, or improved operating conditions. Ask your G-E sales engineer how capacitors can be of specific benefit in your plant. For more information, write for bulletin GED-2978, "The Capacitor Digest," Section 441-114, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

FLORA BALLAST* SHOWS how easy it is to make across-the-counter in-warranty replacement of G-E ballasts at no cost to you, from your nearby G-E Ballast Service Center Distributor. They carry ample stocks of G-E ballasts from which you can select replacements for any make ballast.

Flora explains how . . .*

More Than 800 G-E Ballast Service Centers Help You Save Lighting Dollars

When it is necessary to obtain an immediate ballast replacement you'll get prompt service at the G-E Ballast Service Center Distributor located nearest you. The complete stocks and convenient location help you save time and money. There are G-E Ballast Service Centers in every major city—more than 800 of them in the United States. Here you can make NO CHARGE in-warranty replacements of G-E ballasts . . . and replace *any make* ballast with a high quality G-E unit. And G.E. gives you top quality at low attractive prices too. Save time and money—solve your ballast replacement problems at your nearest G-E Ballast Service Center.

When you buy G-E ballasts you get other services too. G.E. maintains a network of national warehouses to speed volume orders. More than 150 trained sales engineers from G-E Apparatus Sales Offices are available to give you help in applying G-E ballasts and in servicing G-E ballast installations.

A G-E ballast tag or sticker on your fixture is proof that it is equipped with the best in ballast value. It's the easy way to be certain. For a complete presentation on G-E ballasts, contact the G-E Apparatus Sales Office nearest you or write Section 401-16, General Electric Company, Schenectady 5, New York.

*Miss Fluorescent Ballast, G.E.'s Ballast Mascot

Copyright 1955, General Electric Company

EXPERIENCED G-E BALLAST ENGINEERS are available to help you plan and service fluorescent lighting applications. For help, contact your nearest G-E Apparatus Sales Office.

Five more reasons why

GENERAL ELECTRIC IS YOUR BEST BALLAST VALUE

- EXCLUSIVE SOUND RATING SYSTEM
- SUPERIOR QUALITY CONTROL
- LONGER BALLAST LIFE
- PRECISE LAMP-MATCHED DESIGN
- PROVED PRODUCT LEADERSHIP

Progress Is Our Most Important Product

GENERAL ELECTRIC

SHORT-CIRCUIT TEST shows what can happen to an air circuit breaker when its interrupting capacity is exceeded.

Could this happen to your protective devices?

It might! Whenever transformer capacity is added to your electrical system, the magnitude of potential short circuits increases . . . to values that your present devices may not be able to interrupt safely.

YOUR SYSTEM, for example, needs only an installed capacity of 300 kva or more at 480 volts (150 kva at 240 volts) to be subjected to a possible short circuit of 10,000 amperes. Can your present devices clear such faults? General Electric CLF Fuses, Air Circuit Breakers and LB-1 Service Protectors have proven in laboratory tests that they can.

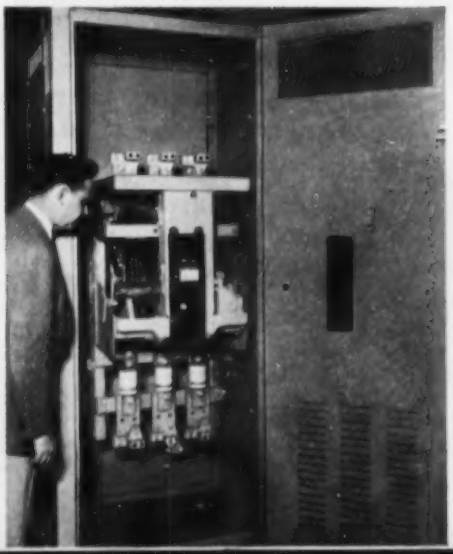
Failure of a protective device is usually accompanied by costly equipment damage and lost production time. Comparing the ratings of your devices against the short circuits they may be required to interrupt can point out the danger areas in your plant. Your G-E sales representative will be happy to help. For more information about the products pictured below, write to General Electric Company, Section 526-2, Schenectady 5, New York.

Progress Is Our Most Important Product

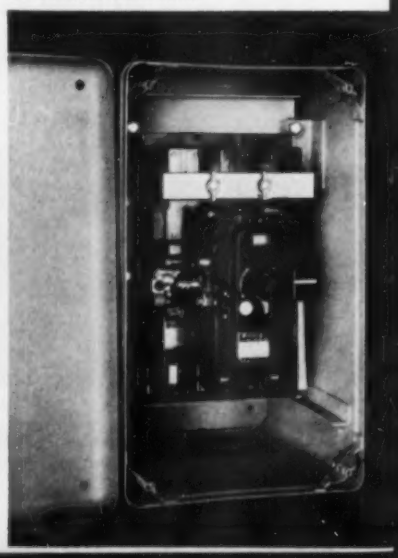
GENERAL ELECTRIC

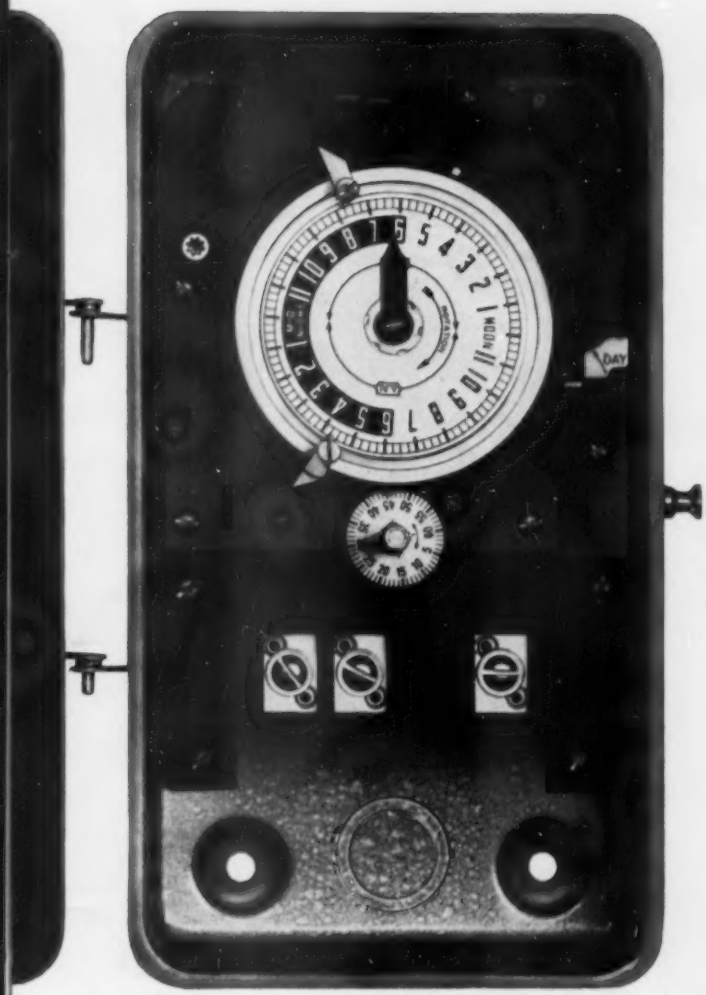
CLF Fuses: available for all applications 600 volts a-c and below, can interrupt 100,000 amps. This high interrupting capacity makes them well-suited for circuits where conventional fuses are inadequate. Ask for bulletin GEA-6319.

LB-1 Service Protector is a heavy-duty load-break switch employing CLF fuses; has a combined interrupting rating of 200,000 amperes at 480 volts and below. Ideal for commercial building service-entrance protection or industrial feeder applications. Ask for bulletin GEA-6527.



AK Air Circuit Breakers will protect a great variety of circuits through 600 volts; available in interrupting ratings from 15,000 through 150,000 amperes. Ask for bulletin GEA-5915.





New General Electric TSA-40 Time Switch At a New Low Price

Now you can get reliability at low cost for any ON-OFF job

The TSA-40 is a completely new heavy duty time switch engineered by General Electric to give you more reliable on-off operation at a lower price.

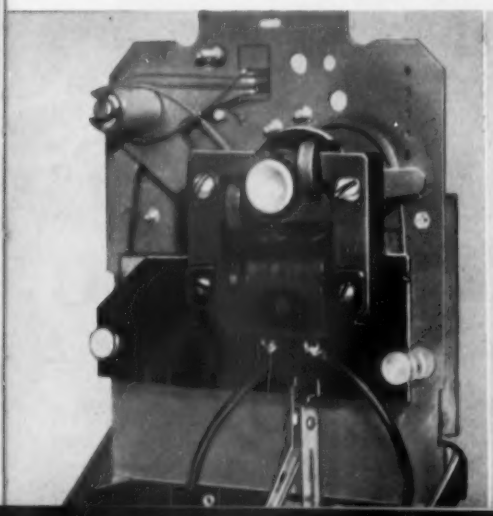
HIGH RELIABILITY of the G-E TSA-40 time switch is made possible by the exclusive contact shearing action, the one-piece terminals and contact blades, and the time-proven Telechron* motor. Now with weatherproof case, the TSA-40 is fully suitable for all types of ON-OFF applications, indoor and outdoor, in temperatures from −50 F to 150 F.

LOW COST means you get this reliability in the TSA-40 at prices starting as low as $22.70**. Not only this, but highly dependable operation means minimum attention, and you save money on maintenance. For off-the-shelf delivery contact your local General Electric time switch distributor or the G-E Apparatus Sales Office nearest you today. Or write for free bulletin to Section 584-5, General Electric Co., Schenectady 5, N. Y.

*Reg. trademark of General Electric Co.
**Manufacturer's suggested resale price for standard SPST model.

GENERAL ELECTRIC

GREATER TEMPERATURE RANGE of −50 F to 150 F is made possible by improved Telechron* motor. Direct drive of switching mechanism assures positive action.



COMPLETELY WEATHERPROOF steel case has press-fit latch for tight seal and easy opening. Side-hinged removable cover simplifies installation and maintenance.

NO WIRING BURNOUTS or "hot spots" because one-piece contact and terminal assembly eliminates all internal wiring to contacts. Unit terminal block makes replacement easy.

WALTER D. VANCE, JR., *Vice President* • *California Electric Co., reports:*

"We saved 14 days installing 527 fixtures by using 'UP-RIGHT' Scaffold-on-Wheels"

Man-hour savings on this General Motors warehouse job amounted to over 40%. Up-Right Scaffold is so light it is easily assembled by one man. Individual 1 piece aluminum alloy sections are unfolded and set one on top of the other. They lock into place instantly.

Write for descriptive circular ➡

"UP-RIGHT" SCAFFOLDS

Dept. 159 • 1013 Pardee Street • Berkeley, California

Factories: Berkeley, Calif. and Teterboro, N. J. • Offices in all principal cities

Time to cash in on

That sudden dose of darkness

NOTHING sells a hardened homeowner on the need for modern electrical wiring like a sudden dose of darkness!

More and more short circuits can be traced to appliances that can't be fed properly with old-fashioned wiring. *You know it, of course, and so does the homeowner!*

Get your share of profitable wiring jobs from old and new homes alike. Use *modern* materials and you'll get the work done faster and better. That means wire and cable insulated with BAKELITE Brand Vinyl Plastic.

Wiring with this thinner-walled insulation strips and splices more easily than older types because individual conductors have no braid or saturating compounds. Its longer service life is a powerful selling point with your customers—BAKELITE Brand Vinyl Plastic maintains electrical and physical properties longer because it resists cracking, stiffening and oxidizing.

BAKELITE Vinyl Plastic is listed by UL for 60 deg. C. (140 deg. F.) building wire and for non-metallic sheathed cable, including the new all-plastic types UF and NMC. Ask your supplier about the many advantages of this modern insulating material that helps you sell and install up-to-the-minute wiring.

BAKELITE BRAND PLASTICS

Remember—everyone benefits from ADEQUATE WIRING insulated with BAKELITE Brand Vinyl Plastic

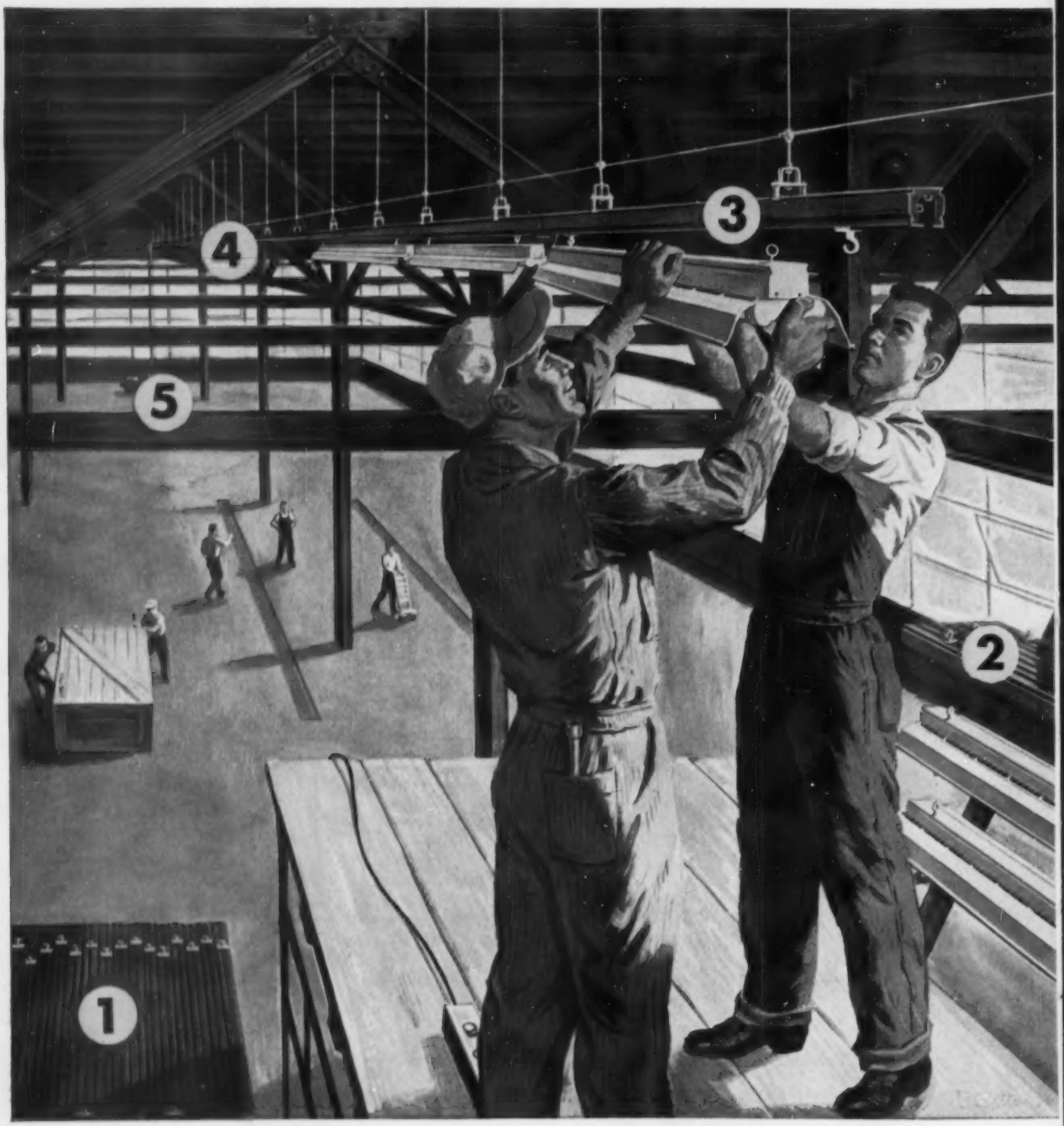
BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC.

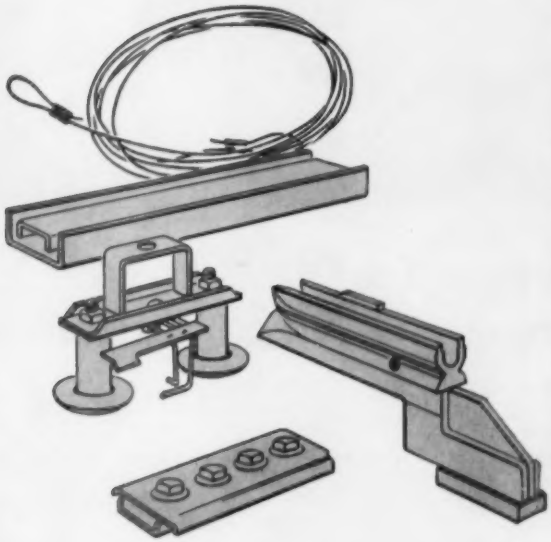
General Electric announces Roll-in Busway technique

Hang busway and fixtures from one then watch installation

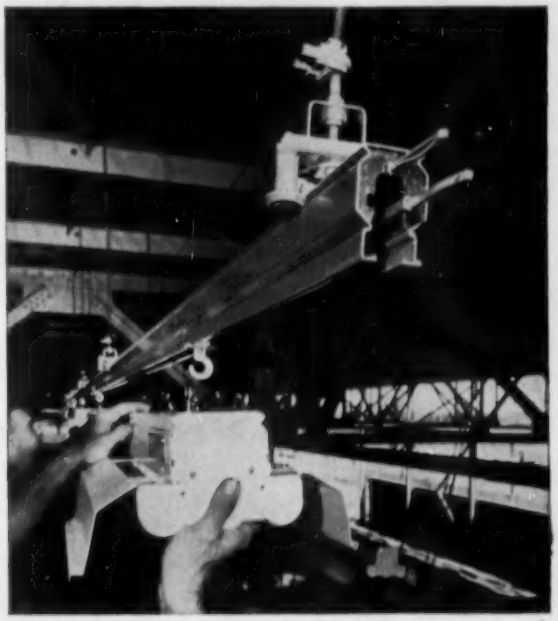


location at one time, roll into place, costs drop 30% to 50%!

1 G-E lighting busway and fluorescent fixtures are assembled on floor. **2** Hoist raises material to work platform. **3** Successive busway sections are placed in hangers and joined. At the same time, fluorescent fixtures are hung from and plugged into the busway. **4** Cable and **5** winch at far end of building pull busway with fixtures through roller-type hangers until the entire system is in place. On several major lighting jobs, G-E busway and closely spaced fixtures have been rolled in at a rate of five feet per minute, or twice the speed normally taken for hanging fixtures alone!



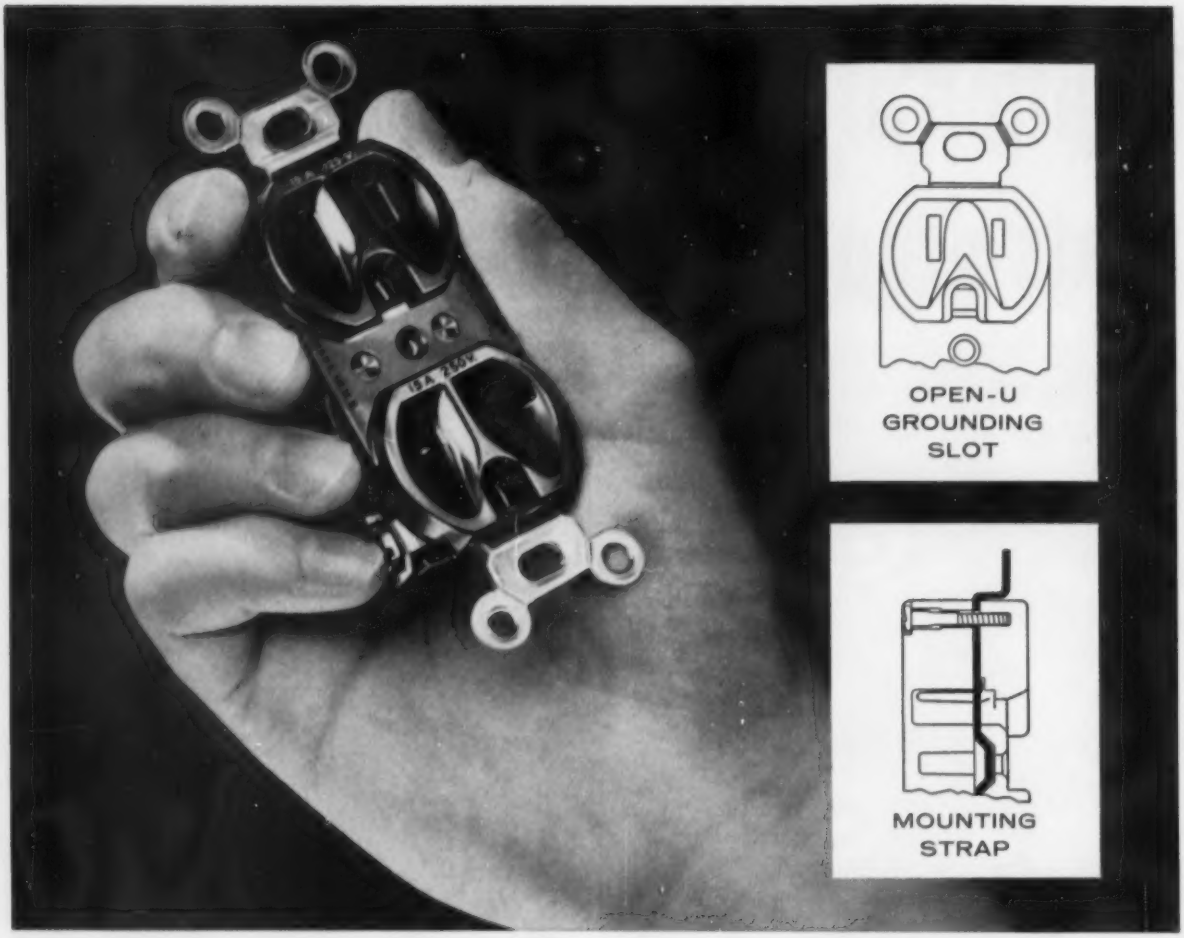
There are only five additional—and minor—parts needed to install General Electric Type LTG lighting busway by the new system. The longer the busway run, the greater will be the installation savings. For complete data, see your nearest G-E representative or write, **General Electric, Distribution Assemblies Dept., Plainville, Conn.**



The busway moves—not the work platform. As each busway section with fixtures attached is hooked up to the preceding section, it is pulled through new roller-type hangers until the entire run is finally in place. The system ends the need for the usual repeated relocation of platforms and other equipment. It allows both the busway and the fixtures to be installed before permanent flooring is laid or machinery put in place, and avoids interference with other plant activities.

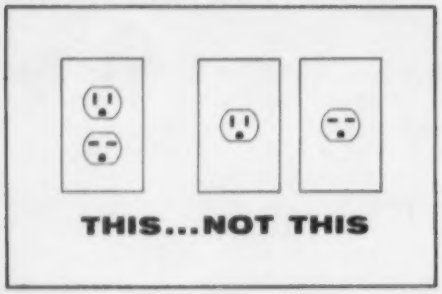
Progress Is Our Most Important Product

GENERAL ELECTRIC



New 2-in-1 Device for 125 Volt and 250 Volt Grounding Applications

NO. 5292 SIDE AND BACK WIRED • NO. 5280 SIDE WIRED • AVAILABLE IN BROWN OR IVORY



Here's the completely new BRYANT combination grounding outlet that fills the growing need for both 125 volt and 250 volt service.

The 250 volt outlet is particularly convenient where air conditioning units, portable heaters and electrical office equipment is used. The 125 volt outlet can be used for standard equipment.

Check these outstanding features which have been built into this quality device:

1. New Open-U grounding slot—eliminates breakage of outlet face.
2. Mounting strap securely anchored between body halves—grounding contact welded directly to strap.
3. Double grounding terminals color coded (green) for easy identification.

J-9997 1A

Listed by Underwriters' Laboratories, Inc.

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut • CHICAGO • LOS ANGELES

BRYANT
APPLIANCE CONTROLS

Now!

SAVE UP TO 15%

with aluminum plug-in bus duct

Bus duct distribution systems engineered with Reynolds Aluminum Bus Conductor are now even more economical because of the present 15% price differential between aluminum and copper plug-in bus ducts. But, that's not all. When new construction, changeovers or plant expansions are necessary, these prefabricated sections can be extended swiftly and at lower installed cost than other methods . . . and they're practically 100% salvageable.

Aluminum bus duct distribution systems are also extremely flexible. They're adaptable to horizontal or vertical layouts in small buildings or large—in stores, office buildings, schools, auditoriums and other buildings. In industrial plants, they minimize downtime for machinery relocation. Outlets are always at hand and circuit changes are made quickly.

CONTRACTORS: Quote aluminum when you figure bus duct distribution systems. Time and labor savings in installation will permit lower, more competitive bids.

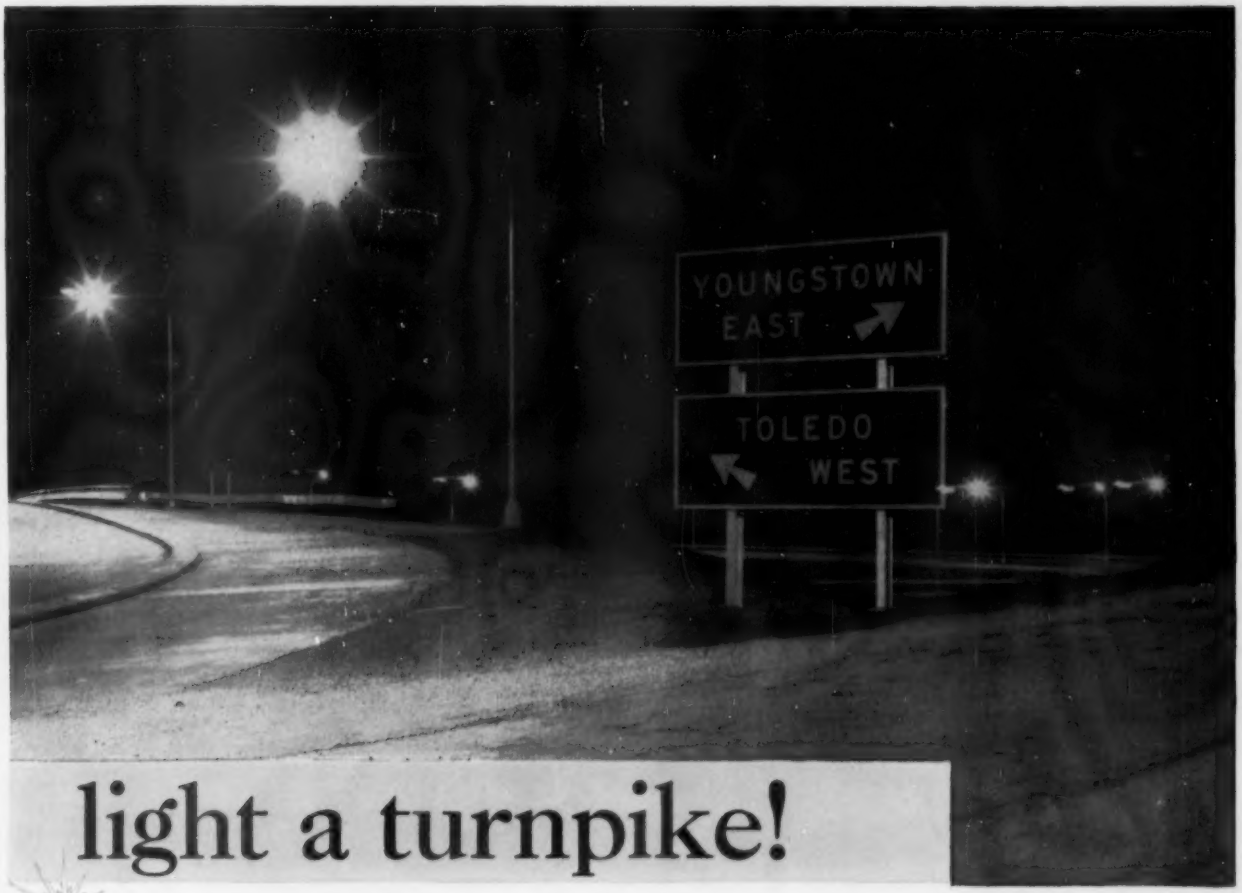
Reynolds Aluminum Bus Conductor

Reynolds pioneered the development of extruded bus conductors now used by all the major bus duct manufacturers. These aluminum conductors are available with a variety of properties and in an unlimited range of sizes and shapes.

Reynolds does not make bus duct distribution systems, but for more information about their advantages and for names of system manufacturers write *Reynolds Metals Company, P.O. Box 1800-ET, Louisville 1, Kentucky.*

See Reynolds New Program, "CIRCUS BOY", Sundays on NBC-TV

HERE'S the way to



light a turnpike!

The new Ohio Turnpike, spanning the state from Pennsylvania to Indiana, is a model of modern highway construction. And one of the outstanding features of this road is the lighting of the interchanges.

What an immense job it was to build this 241-mile road! Enough dirt was excavated to fill a two-lane tunnel 268 miles long. They dumped enough fill to cover 500 football fields to a depth of 28 feet. Carefully the bogs were drained, slides were stopped and the rock was blasted to make the great road possible.

Skillful engineering is apparent along every foot of the Turnpike—and this includes the selection of vital materials used to build it. Buried in the ground near the interchanges you'll find over half a million feet of Tiger Brand 3,000-volt internal shielded cable serving as main feeders. Many thousands of feet of Tiger Brand RR cable serve as bracket cable in the poles, and an additional quarter million feet of Tiger Brand cable grounds the entire system.

When you install Tiger Brand cable, you have gone a long way toward insuring a trouble-free wiring system.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

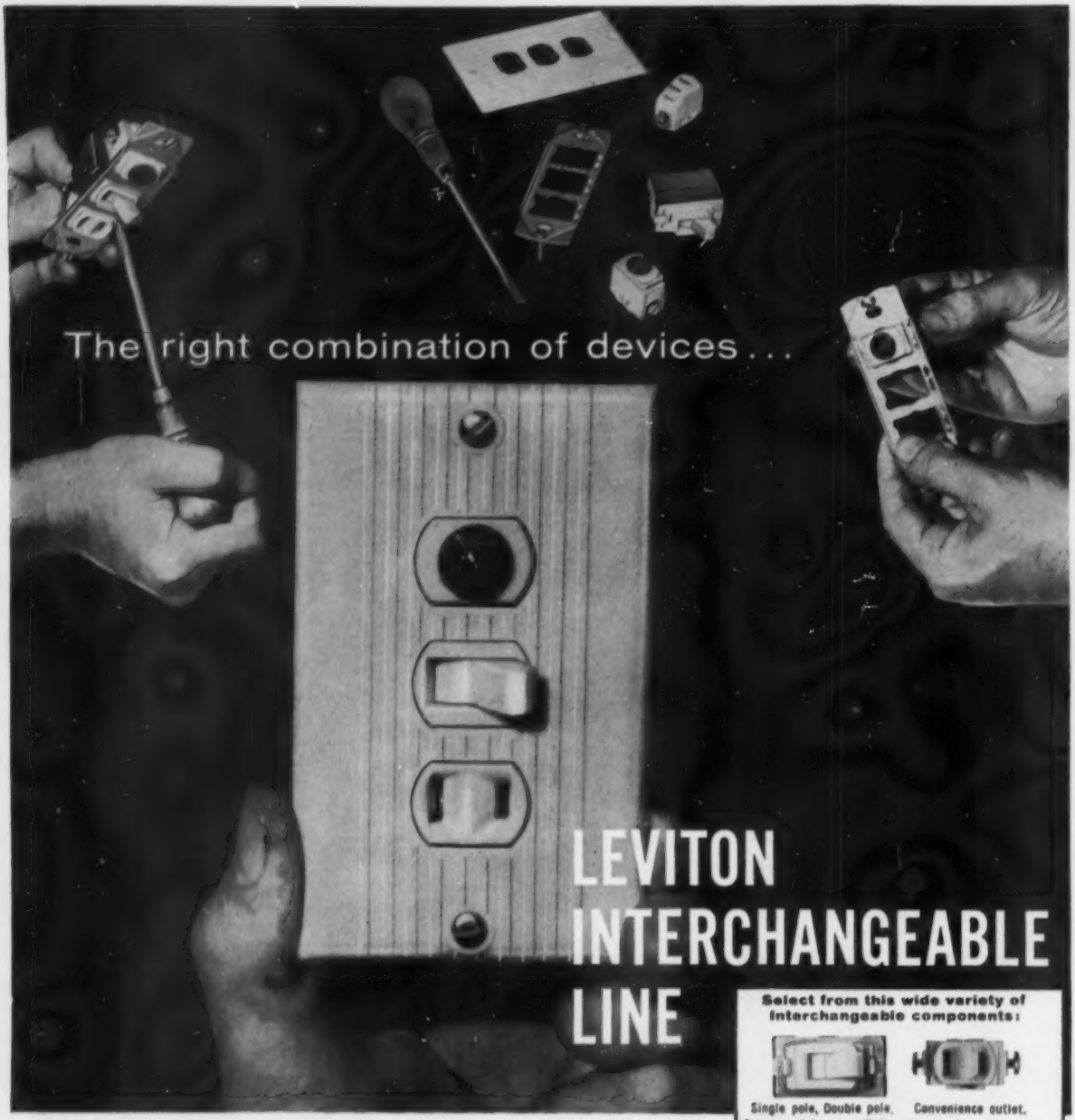
USS TIGER BRAND ELECTRICAL WIRE & CABLE

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- machine tool and building wire
- special purpose wire and cable
- asbestos wire and cable
- paper and varnished cambric cable
- aerial, underground and submarine cable
- shovel and dredge cable
- mold cured portable cord

USS

UNITED STATES STEEL



Now, a newly designed series of devices that can be made up in combination and installed right on the job with a minimum of inventory and a maximum of efficiency. Any combination of one, two or three devices on a single gang can be assembled quickly and easily. Each device locks into the strap with a twist of the screw driver.

With the Leviton Interchangeable Line, you get the devices you want in the combination that is right for the job. And these devices are also interchangeable with other devices of the same type for replacement purposes.

Devices fit standard boxes and wall plates. Available in brown or ivory phenolic. Newly designed wall plates in metal or phenolic are simply styled, easily cleaned. Listed by Underwriters' Laboratories.

Select from this wide variety of interchangeable components:

Single pole, Double pole, 3-way and 4-way switches.

Convenience outlet.

Pilot light.

Push button.

Duplex and Triple outlets.

Your best jobs are done with ... **LEVITON**

For full information write: **LEVITON MANUFACTURING COMPANY • BROOKLYN 22, N. Y.**

Chicago • Los Angeles • Leviton (Canada) Limited, Montreal

For building wire and cable contact our subsidiary AMERICAN INSULATED WIRE CORPORATION

how to make money on lighting fixtures!

PICK A LINE that's well-designed and well-engineered. Design and engineering are absolute essentials of good lighting.

PICK A LINE that's quality-manufactured . . . tops in finish, metal fabrication and in assembly. Owners and users will appreciate your insistence on quality.

PICK A LINE that's designed with the contractor in mind. You'll find installations cleaner, easier and *much more profitable.*

IF you keep these things in mind, we know from experience good lighting installations bring you more and more jobs . . . and we know that Smithcraft will get its share (or more) of your business.

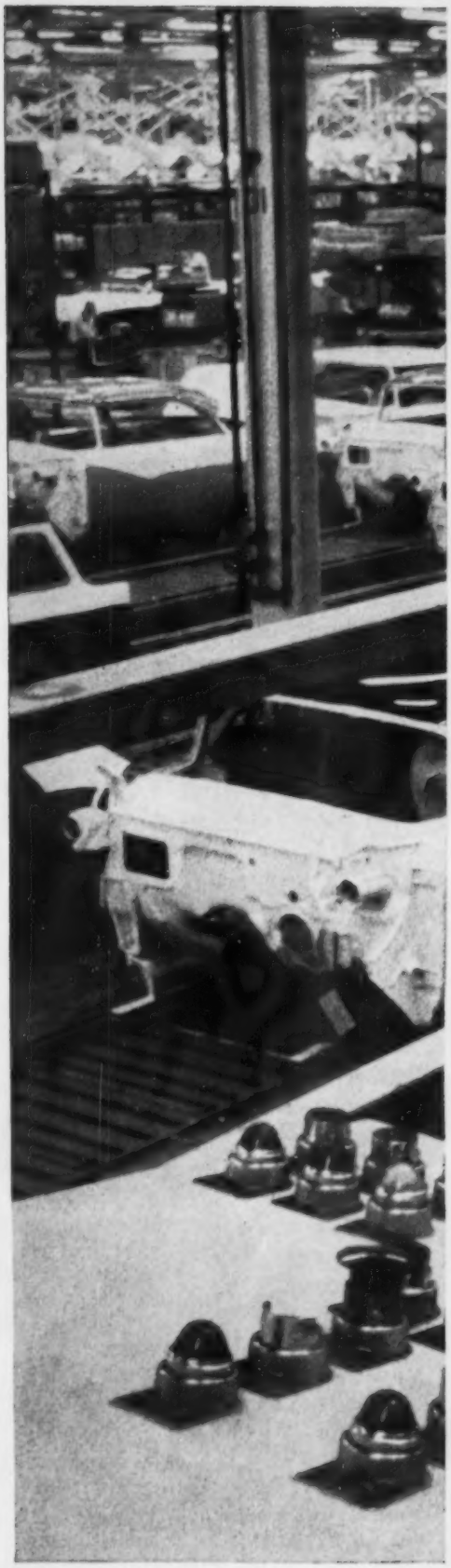
The Sheraton (shown above) is an ideal unit for offices, schools, stores, and all kinds of installations . . . very shallow . . . very easy to install.

Smithcraft
LIGHTING
CHELSEA 50, MASSACHUSETTS

Ask us to send you the current Smithcraft catalog . . . it is a compilation of the newest and most functional fluorescent fixtures in use today.

America's finest fluorescent lighting

Keeping production on the move with Westinghouse pushbuttons



On Ford assembly lines, automation starts with the press of a button. From the paint line (shown), 18 different body styles are automatically guided to various trim lines. As each body passes the operator, he channels it to the proper trim line simply by pressing a button.

In textile mills, steel, paper or fabricating plants, Westinghouse pushbuttons are also on the job, guiding smooth-functioning lines of material to finished product stages. Doing it faster, better, and at a lower operating cost to you than ever before possible.

From Westinghouse you can get precisely the right operator, enclosure, whatever you need—when you need it. Complete lines of standard-duty, heavy-duty, and Oil-Tite* pushbuttons are stock items with Westinghouse.

Write to Westinghouse, Box 868, Pittsburgh 30, Pa., or see your nearby Westinghouse distributor for a copy of the new *Pushbutton Guide*, B-6749.

*Trade-Mark

J-30229

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU**!*

Photo courtesy Public Service Electric and Gas Company of New Jersey

J-M Transite Ducts go in quickly, easily and permanently

Quick, low-cost installation is promoted by Transite Ducts. The light, 10-foot lengths are easily handled . . . and readily joined with either Transite Couplings or J-M Plastic Couplings. Many fittings are available to simplify even the most complicated installation. The permanently smooth interior surface of these asbestos-cement ducts prevents cable injury, makes long pulls possible and simplifies cable replacement.

Incombustible Transite Ducts confine arc damage, protecting adjacent cables from heat and flame. Inorganic, nonmetallic, Transite Ducts are corrosion-resistant, immune to rust and rot and unaffected by electrolysis. These ducts dissipate heat faster, reducing I^2R losses, enable cables to carry heavier loads and prolong insulation life.

Available in 2 types: Transite Conduit for exposed work and installation underground without concrete encasement; and Transite Korduct for installation in concrete.

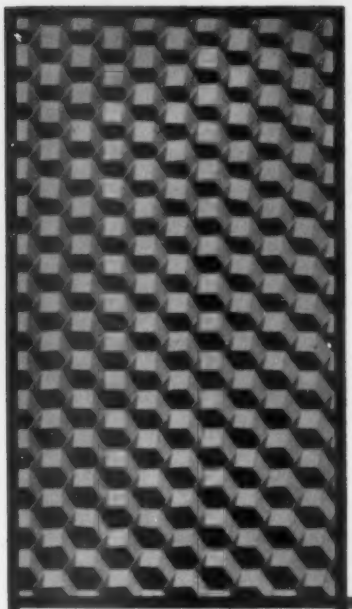
Let us send you more information about Transite Ducts. Just write to Johns-Manville, Box 14, New York 16, N. Y.

JM PRODUCTS

Johns-Manville TRANSITE® DUCTS

TRANSITE KORDUCT®—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement



THIS IS HONEYLITE®

Bright as a summer day

quiet as a winter night

Honeylite—the all metal light diffusing acoustical aluminum honeycomb—sets new highs in light transmission efficiency...and at the same time, and in the same place... reduces noise to new lows.
Honeylite's 95% plus efficiency puts a soft, even light in every corner of the room, while producing the minimum surface glare.
Honeylite's noise reduction coefficient of .46 keeps rooms quiet, and costs down by eliminating the need for acoustical baffles.
Honeylite may be used wherever pleasant, non-glare interior light is the goal. Because it weighs only two ounces a square foot it can be suspended from any simple T-bar system.
Fireproof Honeylite has underwriter's approval to be suspended under sprinkler systems; and its 45° shielding effect completely hides any ugly overhead utility installations.
Easy-to-maintain Honeylite is used in industrial or commercial interiors, in suspended louver-all ceilings or troffer diffusers.
Honeylite is truly the new lightweight champion!
For price lists and detailed information see your local distributor or write to

HEXCEL PRODUCTS INC.
951-61st Street, Oakland 8, California

G-E LAMPS GIVE YOU MORE FOR ALL YOUR LIGHTING DOLLARS

You can "measure" the light output of G-E fluorescent lamps, *right in the carton!*

GENERAL ELECTRIC UNIFORMITY IS WHY—G-E 40-watt fluorescent lamps give you all the light you pay for. Their light output is so uniform that you're assured of their performance—even before you put one in a socket. There's practically no such thing as a "lazy" G-E lamp—a lamp that uses full power without delivering its rated lumen output. Less than 1% of all General Electric 40-watt fluorescent lamps are as much as 5% below their average published light output of 2500 lumens.

G-E LAMPS SAVE YOU MONEY—Today's General Electric 40-watt fluorescent lamps deliver 30% *more* light than those you bought in 1950. Based on the average cost of burning 24 G-E 40-watt fluorescent lamps, this gives you a *bonus of light* worth almost $55! Put another way, this *extra* light equals the total light output of 79 100-watt incandescent bulbs over their entire life!

But G-E lamp uniformity means more than uniform *light* output. It also means freedom from defects—on the average, 99.9% of all G-E 40-watt fluorescent lamps are free from physical defects that could affect performance in service. And uniform life, too, means that after one year of service in single shift plants (2500 hours) an average of 99 out of 100 General Electric 40-watt fluorescent lamps will still be burning—98 out of 100 will still be in service after a year in double shift plants (4000 hours).

For more information on what uniformity in G-E fluorescent lamps means to you write: General Electric Co., Large Lamp Dept. EC-11, Nela Park, Cleveland 12, O.

Progress Is Our Most Important Product

GENERAL ELECTRIC

EASY WAY

TO FINISH A JOB

MULTIMOUNT LUG
SINGLE LUG
TWIN LUG
SPLICER
Socket set screws furnished as standard. Hex head screws available on all fittings at no extra cost. L35 and L70 furnished with slotted screw to allow tightening with screwdriver.
BLACKBURN
L250-2

BLACKBURN

TERMINAL LUGS AND SPLICERS

- Quickly Installed—No Special Tools Required
- Highest Quality Materials Throughout
- Rugged, Durable Construction; Compact Design
- Choice of Bolt—Screw, Socket or Hex-head
- Economically Priced

Available Through Electrical Wholesalers Everywhere
Write for Latest Lug Bulletin Containing Specifications and Prices

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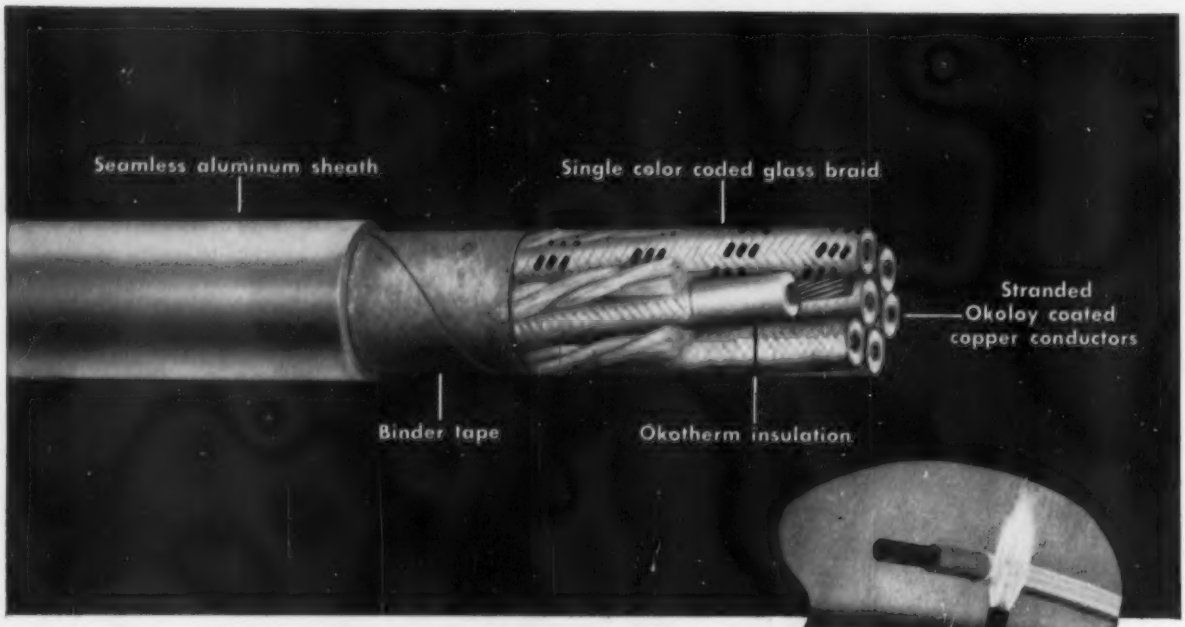


lick temperatures up to 392° F and eliminate conduit with OKOTHERM aluminum-sheathed cable

Heat and flame resistance. Direct flame on the individual conductors will not cause circuit failure.

Eliminate conduit and pulling problems. This small diameter, light-weight construction can be bent to a radius of 6 times the cable O.D. with standard conduit tools. It reduces installation costs, and provides a compact, neat construction for congested areas.

Moisture-proof installation. Even without its watertight seamless aluminum sheath, Okotherm insulation itself has excellent moisture resistance.

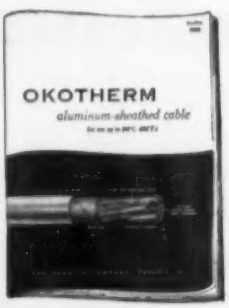
Standard fittings available. Moisture- and heat-proof connectors are available through Thomas & Betts Company distributors.

Use regular installation methods. Okotherm-insulated conductors are handled just like familiar, rubber-insulated wire. The individual conductors can be readily fanned out, trained and terminated.

Resists corrosion. Corrosive gases, aromatic solvents and many other chemical products do not harm the aluminum sheath.

Range of design. #19 Awg through #4/0 Awg stranded, up to 61 conductors depending on their size, can be supplied with seamless aluminum sheath. Present manufacturing facilities permit lengths up to 500'.

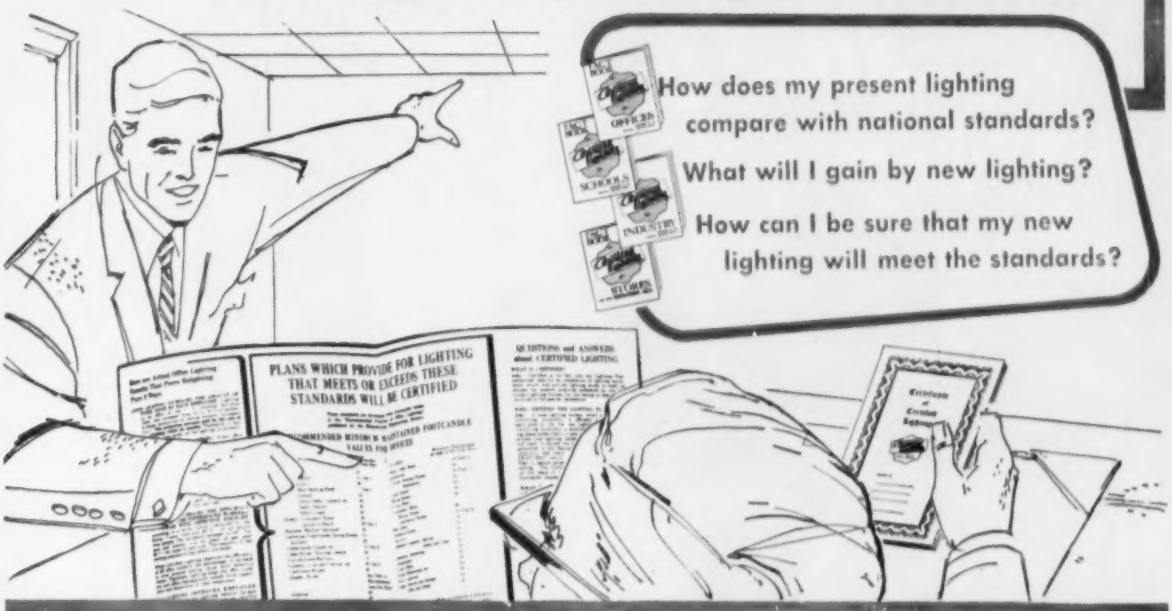
Okotherm insulation, compounded from silicone rubber, is a thermosetting material with an eight year successful service record. It is especially useful in power plants, steel mills, pulp and paper mills, oil refineries, petrochemical applications. For additional detailed information, write for Bulletin EC-1088 to The Okonite Company, Passaic, New Jersey.



OKONITE SINCE 1878 *insulated cables*

3149

The 3 Most Important Questions On Your Lighting Prospect's Mind!


How does my present lighting compare with national standards?
What will I gain by new lighting?
How can I be sure that my new lighting will meet the standards?
PLANS WHICH PROVIDE FOR LIGHTING THAT MEETS OR EXCEEDS THESE STANDARDS WILL BE CERTIFIED

Use the FACT BOOKS for the answers! Then use the CERTIFICATE to clinch the sale!

Sell more and bigger lighting jobs by using the Fact Books of Certified Lighting in your sales approach. They are available to electrical contractors and others wherever the Certified Lighting program is in operation. Use them to show your prospect the national standards and how his present lighting compares with these standards. There is a Fact Book for each type of lighting — for store . . . office . . . school . . . and factory. Use the Fact Books also to show how your plan is certified by an impartial authority and countersigned by you to guarantee that the installation meets national standards. Then . . . use the guarantee certificate itself as the final sales clincher to prove your recommendation is *right in plan — right with standards — right for installation.* Send for free booklet and *free* copies of the four FACT BOOKS today!

Is Certified Lighting In Operation In Your Area?

This program is operated locally under the joint sponsorship of all electrical groups. If your area is listed below, get in touch with your local group . . . otherwise, write The National Lighting Bureau.

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Certified Lighting for a Better America

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Certified Lighting

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R-1350B-9

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Quadrangle Mfg. Co.
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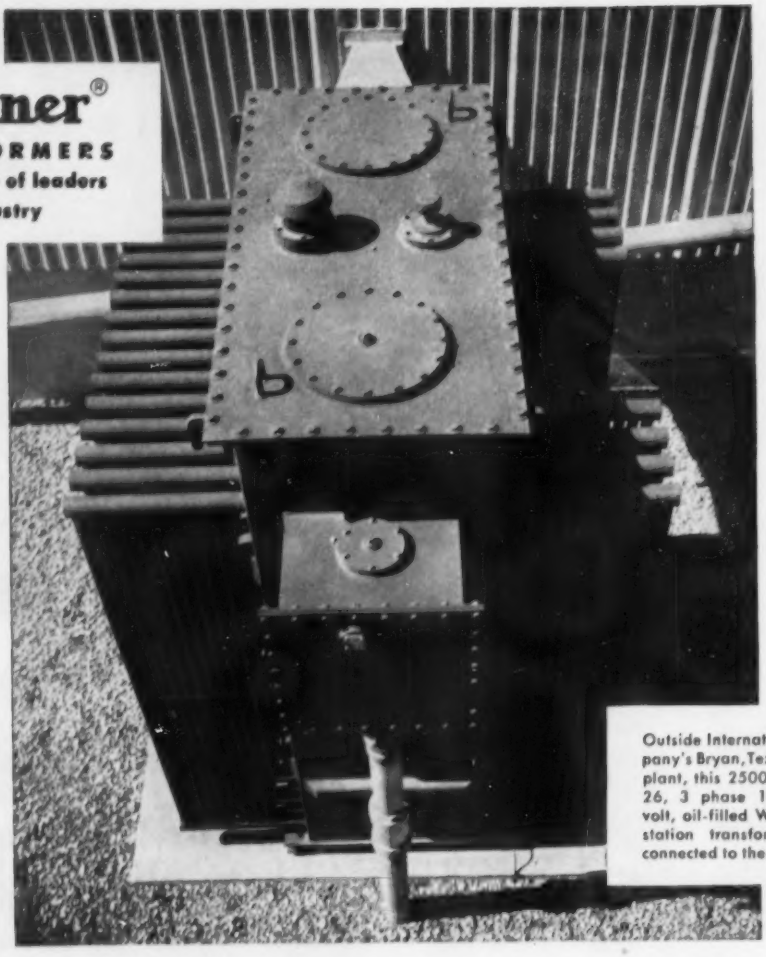
The Wiremold Co.

Wagner®
TRANSFORMERS
... the choice of leaders in industry



Outside International Shoe Company's Bryan, Texas rubber soling plant, this 2500 kva, type HPA-26, 3 phase 12,500 to 2400 volt, oil-filled Wagner unit substation transformer is throat-connected to the loud-center.

WAGNER UNIT SUBSTATION TRANSFORMERS

... liberally designed to give years and years of service ...

The importance of the transformers in your plant power distribution system cannot be over-emphasized. If a switch or a circuit breaker fails, only a part of the system is affected—but if the transformer fails, the entire system is dead. Think of the cost to your plant in terms of cancelled orders and lost manhours in the event your present system broke down.

International Shoe Company, world's largest shoe manufacturer, has made sure the distribution system in their Bryan, Texas rubber soling plant has a power supply adequate to meet all their power needs. They want ample, maintenance-free, reliable service for a long time to come. That's why International chose a Wagner unit substation transformer for this plant.

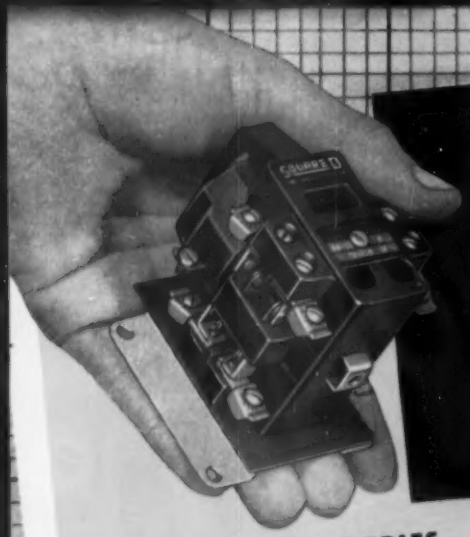
Why not discuss your next transformer installation with the Wagner engineer nearest you? There are Wagner branches in 32 principal cities. Bulletin TU-181 gives full information on Wagner Power Transformers and Bulletin TU-205 tells about Wagner Unit Substation Transformers. Write today for your copies.

Wagner Electric Corporation
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

WT56-2

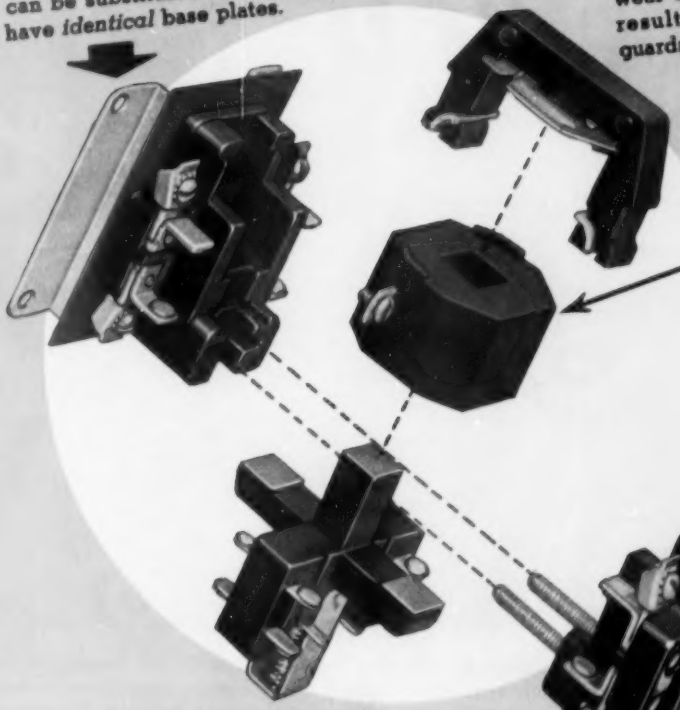
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS–AIR AND HYDRAULIC



this new, small size SQUARE D RELAY has features you'll like!

NO MOUNTING WORRIES
When more contacts are required, the 4-pole relay (DO-42) can be substituted for the 2-pole (DO-22). Both have *identical* base plates.

OUTSTANDING PERFORMANCE
Balanced construction reduces wear on single moving part... results in long life and safeguards against down time.



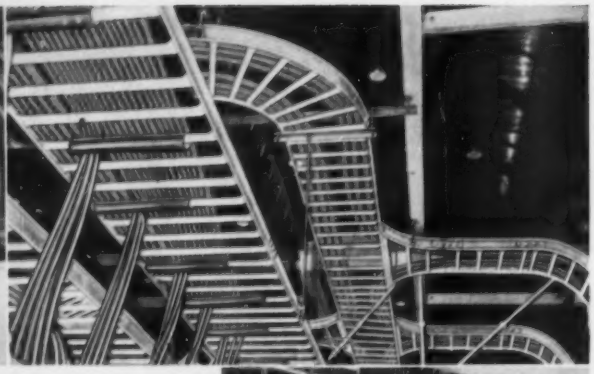
RESISTS DAMAGE
Plastic impregnated molded coil is unbreakable, operates cooler, is dimensionally stable and impenetrable by water and oil.

20-SECOND DISASSEMBLY
Simply loosen two screws and the entire device is disassembled for normal maintenance.

This new **Class 8501 Type D relay** is amazingly compact. 2-pole version measures only 3 1/16" high x 2 5/8" wide! 4-pole is only 3 11/16" high x 2 13/16" wide! Both rated 10 amperes, 600 volts. Packaged parts kits make normal maintenance easier than ever. Write for Bulletin 8501 which tells the complete story. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY



WHAT AN INSPIRATION—

this installation of...

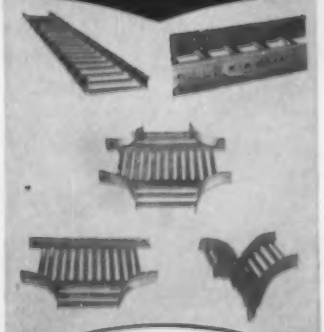
Globetray* RACEWAYS

at

INSPIRATION COPPER MINES

Miami, Arizona

EASY TO INSTALL • SAVES TIME
SAVES ON MATERIAL • GALVANIZED
NO MAINTENANCE PROBLEM



Globetray, a new, superior system of CABLE and TUBING RACEWAYS, is a completely engineered method of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests The Universal splice plate joins all parts through the side channels only and all curved fittings are joined at the ends of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Available in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time Globetray can be cut to length at *any* point — insides and bottom always smooth — all sections punched for easy installation — a perfect fit at all times Neat, clean and uniform in appearance.

Write for new, complete catalog. Distributors in all principal cities. Contact the Globetray distributor under "conduits" in the classified telephone directory.

* Pat. Pending

Globetray
THE GLOBE COMPANY

The GLOBE Company
Manufacturers Since 1914
4032 S. PRINCETON AVE. • CHICAGO 9, ILL.

ROYAL PORTABLE CABLES

Still in Service after 29 years, 24 hours a day

and without a single splice, patch or power failure!

This amazing record was made by a 175-foot length of U. S. Royal portable cable installed in 1927 as a source of power for a traveling agitator in a cement plant*. This three-conductor cable has been fully exposed to weather for the entire 29 years. The agitator moves back and forth the length of the slurry basin, and the cable is simultaneously taken up and paid out by a revolving drum.

To "U. S." engineers, performances such as this are not too unusual. They stem, right at the start, from the determination of "U. S." technicians to produce only a *quality* product. This is possible because "U. S." is the only wire manufacturer to grow its own natural rubber, make its own synthetic rubber and its own plastics, assuring complete quality control with the help of unmatched research and manufacturing facilities.

Call on the "U. S." wire and cable specialist to solve any wiring problem. Write United States Rubber Company, Rockefeller Center, New York 20, N. Y.

*Penn-Dixie Cement Corp., Tenn.

Watch NCAA football, Saturday afternoons, NBC-TV

Electrical Wire & Cable Department

United States Rubber

MICRO precision switches

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN

H HONEYWELL

THIS SWITCH IS PAYING PLANT OPERATORS BIG DIVIDENDS IN INCREASED PRODUCTION

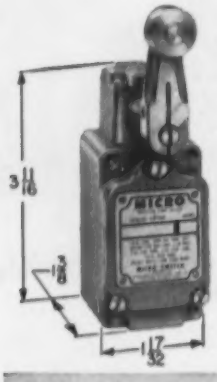
Compact "LS" high-capacity, sealed 2-circuit switch

The MICRO SWITCH "LS" limit switch fills the need for a small, rugged, reliable, two-circuit precision switch to meet the widest possible switch requirements.

All moving parts and the switching chamber are completely sealed, protected from wear or becoming fouled. Field adjustability permits its use in practically any type of application or location.

Two-circuit contact arrangement allows flexibility in circuit design. Reliability of the precision, snap-action unit assures accurate repeat operations throughout many millions of hard, fast actuations. Small and compact in size, this switch is a precision device—yet it is designed and built to stand the most severe abuse.

Like many other precision switches in the MICRO SWITCH line, this versatile switch is ideal for installation on present plant equipment as a limit, interlock or safety switch. So used, MICRO SWITCH precision switches make machinery more automatic, more productive and safer in operation.

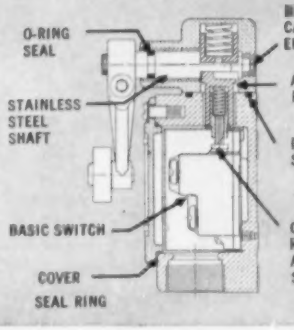


FIELD ADJUSTABLE ACTUATOR

The roller arm actuator is field adjustable through 360 degrees, positively locking in any position. Actuators are assembled to operate in either direction. They can also be converted to operate in one direction only, clockwise or counterclockwise.

SEALS PROVIDE MAXIMUM PROTECTION

Sealing is provided by use of O-ring seals on the actuator shaft and between the actuator head and the housing. A synthetic rubber ring seal is provided for the cover. These seals protect against entrance of dust, oil and other liquids. The switch meets NEMA specifications for an oil-tight pilot device.



TWO-CIRCUIT, DOUBLE-BREAK CONTACT ARRANGEMENT

The electrical rating is: 10 amperes 120, 250 or 460 volts a-c; ½ H.P. 125 volts a-c; 1 H.P. 230 volts a-c; .8 ampere 125 volts d-c; .4 ampere 250 volts d-c; .1 ampere 550 volts d-c. Pilot duty rating is 600 volts a-c max.

Send for Catalog 83 "Industrial Enclosed Switches"

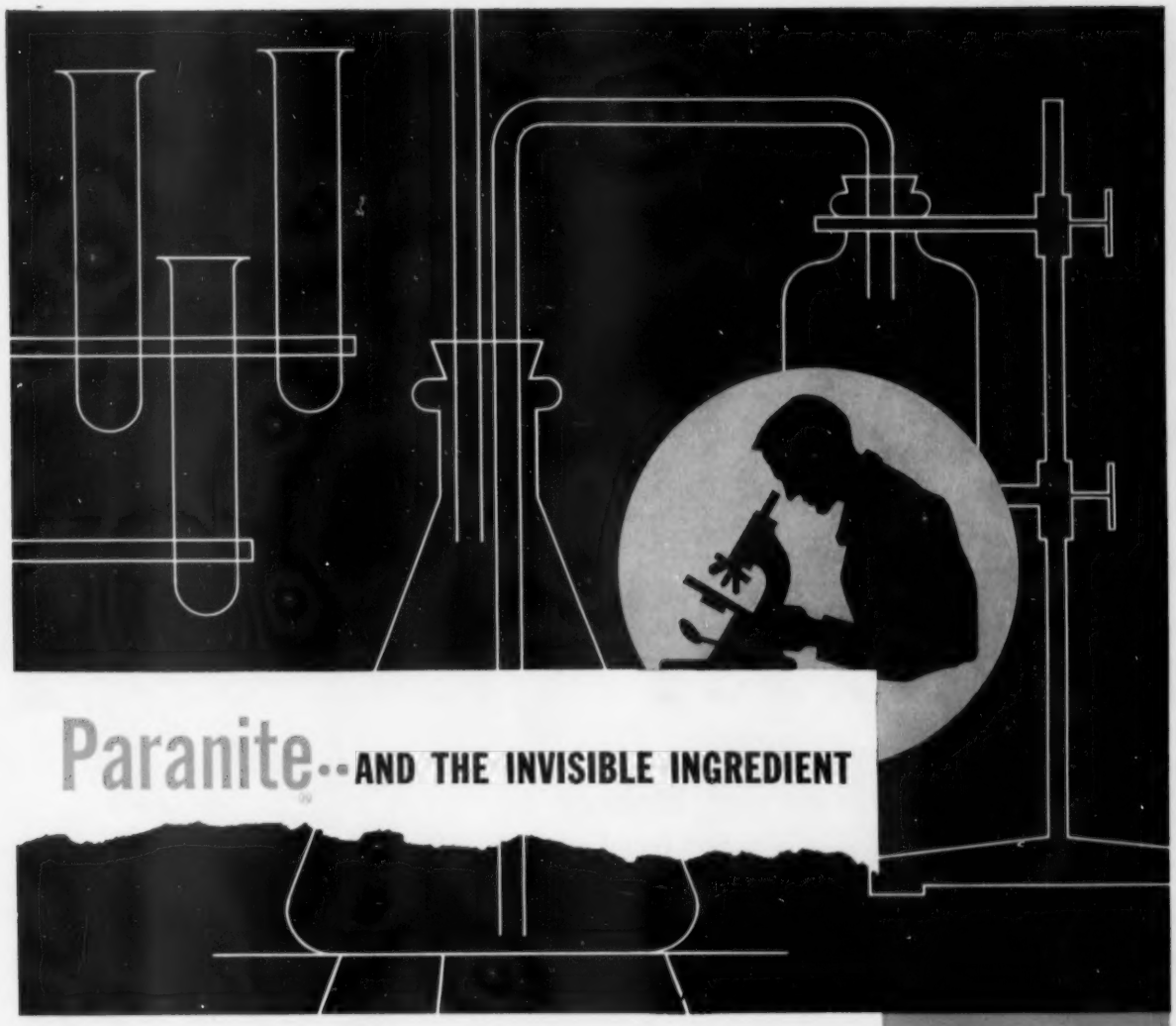
MICRO SWITCH precision switches are sold in key cities everywhere. Look for the distributor nearest you. See "Switches, Electric" in the Yellow Pages.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

H HONEYWELL

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS



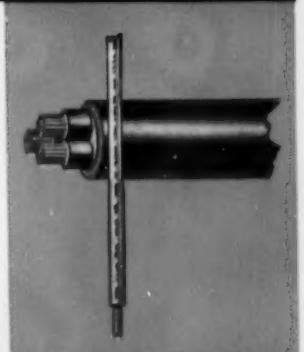
Paranite--AND THE INVISIBLE INGREDIENT

● Electrical wholesalers and contractors coined a phrase decades ago expressing their confidence in Paranite products: "If It's Paranite, It's Right!" This reference by the trade became so common that in time the company adopted it as the Paranite slogan.

The privilege of enjoying such confidence didn't just happen. It was the direct result of the determination of everyone at Paranite to produce a better product each day than the day before, if humanly possible. This desire to achieve perfection has given Paranite products an "extra" that you cannot see ...or feel...and is truly an *invisible ingredient!*

SQC . . . Statistical Quality Control . . . for years has kept a constant, watchful eye on Paranite products. Scores of tests, graphs and measurements are made and analyzed daily by Paranite engineers seeking ways to give you superior products. This, too, is an important part of the *invisible ingredient.*

So specify Paranite . . . and be assured that every foot of wire and cable will be as nearly perfect as human hands can make it—utilizing modern equipment and cautious testing. This is the *invisible ingredient* working silently at Paranite . . . to your advantage! True today as in the past: "If It's Paranite, It's Right!"



From POWER CABLE to FIXTURE WIRE . . . you'll find Paranite quality high . . . service outstanding!

PARANITE WIRE AND CABLE

DIVISION ESSEX WIRE CORPORATION

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MANUFACTURING PLANTS: **Birmingham, Ala.; Anaheim, Calif.; Jonesboro, Ind.; Marion, Ind.**

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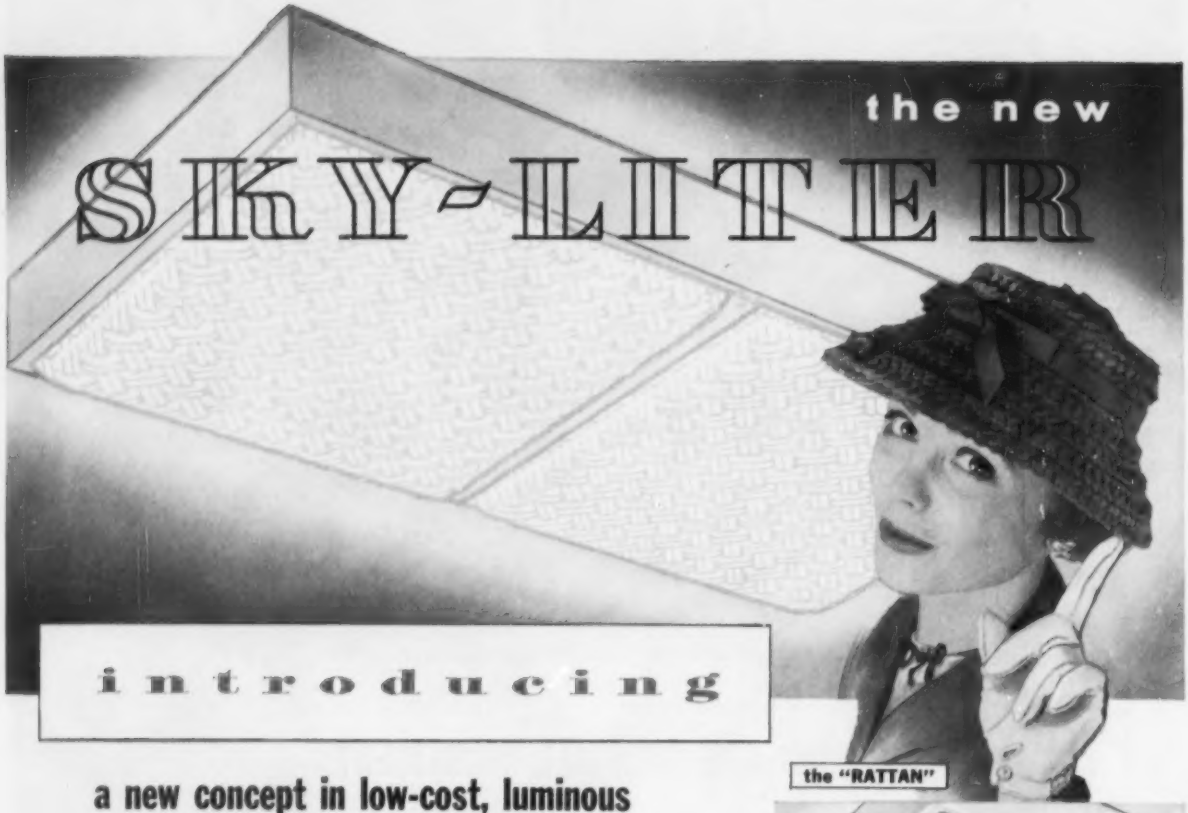
***Atlanta, Georgia; Boston, Massachusetts; *Chicago, Illinois; Cleveland, Ohio; Dallas, Texas; *Detroit, Michigan; Hartford, Connecticut; Indianapolis, Indiana; *Kansas City, Missouri; *Los Angeles, California; *Newark, New Jersey; Omaha, Nebraska; *Portland, Oregon; Upper Darby (Philadelphia), Pennsylvania; Rochester, New York; *Saint Louis, Missouri; *San Francisco, California; Seattle, Washington; Springfield, Illinois.**



a new concept in low-cost, luminous beauty that affords greater freedom of architectural expression

Here's a new Benjamin lighting system, packed with possibilities. Its luminous beauty and choice of three designs make Sky-Liter the finest answer to today's quest for distinctively-lighted interiors.

Sky-Liter units are available for surface or recessed mounting. Choose from 2′ x 2′, 2′ x 4′ or 2′ x 8′ sizes, with 24″, 20-watt (Trigger Start); 48″ Rapid Start; or 96″ Slimline lamps. Special 2′ x 2′ translucent plastic panels efficiently diffuse the light. Panels are easily removed for lamp replacement or servicing, will not warp or discolor.

BENJAMIN ELECTRIC MFG. CO., DES PLAINES, ILLINOIS

Unique "Rattan" design in Vinylite (large illustration) enhances ceiling beauty with its unusual pattern, while the "Saxon" features down-to-earth simplicity in distinctive Plexiglass.

The distinctive beauty of the new "Safari" design emphasizes the great versatility of the Sky-Liter System. For added variety, recessed or surface-mounted units may be installed individually, in tandem, parallel or at right angles to achieve any geometric design.

Fashioned in Vinylite, the "Crystal" presents a multiple-faceted surface that lends beauty and quality to any type of ceiling.

when all things are considered...the better lighting choice is **BENJAMIN**

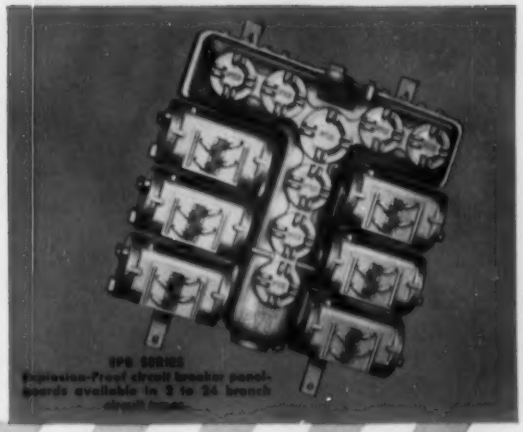
Certified Lighting for a Better America

Sold Exclusively Through Electrical Distributors

1408-R

SPECIFY...

PYLETS®



EPD SERIES
Explosion-Proof circuit breaker panelboards available in 2 to 24 branch circuit ratings.

FOR HAZARDOUS LOCATIONS

Second to none for...

SAFETY: Explosion-proof and dust-tight PYLETS *exceed* code requirements and provide maximum protection for personnel and property against fire and explosion.

ECONOMY: PYLETS are designed for quick, easy installation and convenient maintenance. Rugged construction insures a long service life.

- TAPER TAPPED HUBS
- SMOOTH, ROOMY INTERIORS
- QUICK ACTING JOINTS
- DEPENDABLE MECHANISMS
- ALUMINUM ALLOY OR HEAVY CADMIUM PLATED FERROUS ALLOY CASTINGS

SINCE 1897

THE PYLE-NATIONAL COMPANY

WHERE QUALITY IS TRADITIONAL

1344 North Kostner Avenue, Chicago 51, Illinois

Branch Offices and Agents in Principal Cities of the U.S. and Canada • Canadian Agent: The Holden Co., Ltd., Montreal
Railroad Export Department: International Railway Supply Co., 30 Church St., New York 7, N.Y.
Industrial Export Department: Rocke International Corp., 13 E. 40th St., New York 16, N.Y.

Now you need only half the former space with General Electric's new 30 amp, 600 volt HCI safety switch!

This HCI safety switch, both heavy and standard duty, has a new compact design measuring only 7⅜" wide x 9¼" high x 5¾" deep! In less than half the former space, you get the same dependable protection and these important benefits:

Long life, dependable performance. G-E arc quenchers quickly divide and snuff out arcs, help prevent pitting and burning of contacts. Heavy steel box has Bonderite† corrosion-resistant finish and butt-hinged door for rugged durability.

Speedy installation and maintenance. Front operated handle makes close ganging easy with the heavy duty model; front fusing on both models means fast access to fuses, efficient heat dispersal. Double-break HCI pole units can be individually replaced.

Better protection, greater safety. Quick-make, quick-break contacts can't be teased in or out. Switch handle locks OFF or ON. When switch door is open, special line shield on heavy duty model guards operator against accidental contact with live parts. *General Electric Company, Circuit Protective Devices Department, Plainville, Conn.*

Use these catalog numbers to order 30 amp, 600 volt HCI switches from your G-E Distributor:

Type H, heavy duty, front operated, 3 pole*		Type S, standard duty, side operated, 3 pole*	
Fusible	No fuse	Fusible	No fuse
TC903615D	TC453615D	TC60361	TC30361

†Parker Rust Proof Co. *UL Listed

GENERAL ELECTRIC

Super Durabake A NEW FINISH FOR S&C METALCLAD SWITCHGEAR

Developed for rigorous outdoor or indoor service, Super Durabake withstands high temperatures, high humidities, blasting effects of wind and sand, and corrosive atmospheres. See below how this tough finish is achieved.

prevents rust, eliminates maintenance wherever installed

1 All enclosures are fabricated of scale-free, oxide-free, cold-rolled steel sheets, permitting a smooth, blemishless finish found only on top-grade consumer items.

2 Surfaces to be welded, later inaccessible, receive special preparation which consists of a phosphatizing bath plus an application of metallic zinc.

3 All welds are ground and sanded to remove the scale formed during welding. All internal welds, seams, joints, and splices are wire brushed.

4 The enclosure and all parts are phosphatized. This treatment removes any remaining grease or oil, etches the steel slightly, and forms a neutral, rust-resistant coating.

5 Metallic zinc in alkyd resin is sprayed on all inside and outside surfaces of the enclosure and all parts which are then baked in a huge oven at 300 degrees F.

6 A rust-resistant primer (zinc-chromate-iron oxide) is applied by the spray method to all surfaces. This coat is allowed to air-dry thoroughly before processing continues.

7 The finish coat, of melamine and alkyd resins, is hot-sprayed, permitting an unusually thick, homogeneous coating without runs, sags, or blisters. It is equivalent to a four-coat air-dry finish.

8 All parts are baked at 300 degrees F producing a hard, dense surface required for long life and smart appearance, impossible to achieve with air-dry finishes. Baking is done in an extra-large oven unique in the switchgear industry.

9 For added protection against ground moisture, a thick coat of asphalt paint is applied to the enclosure's bottom perimeter. A heavy coat of "Insulmat," a "no-drip" compound, is applied to the inside surface of the roof to prevent condensation.

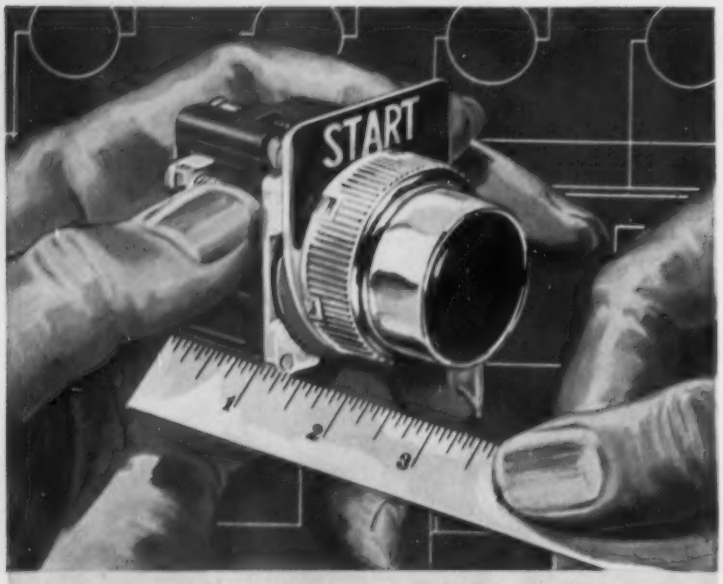
S&C

ELECTRIC COMPANY

4433 Ravenswood Avenue, Chicago 40, Illinois

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.

Now...for machinery designers...new heavy duty pushbutton units built to the standards of the spectacular new Cutler-Hammer Three-Star Motor Control



These are the world's smallest heavy duty pushbuttons. They require a behind-the-panel depth of only 1 3/32". This is 40% less space than needed by the next smallest units on the market. Double-pole contact blocks are available in all combinations of normally open and normally closed contacts. Each control circuit is electrically and mechanically isolated from the other. Each circuit is clearly identified and all terminals are color coded. Rapid on-the-job circuit additions are obtained by stacking contact block on contact block.

☆ *they install easier*

☆ *they work better*

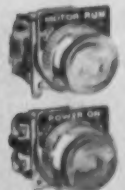
☆ *they last longer*

Design engineers are quick to recognize that these new heavy duty pushbuttons have *everything*. There is nothing on the market like them. They are amazingly compact to require the least back-of-panel depth. They are one-hole mounting and they are oil tight. They easily provide for as many as eight separate control circuits per pushbutton, eight completely isolated heavy duty contacts either normally open or normally closed. The buttons may be flush type, the extended type or with mushroom heads. They can be black, red, yellow, green or gray. See the new one-button control station, C-H Roto-Push. See the easiest-to-install maintained-contact pushbutton attachment and the means for padlocking any of the standard pushbuttons. There are both knob and key operated selector switches in this complete line. Also matching indicating lights and the new automation safety light, PresTest. Be sure you have complete information *now*. Write today on your company letterhead for a copy of the new Cutler-Hammer Panel Builders Handbook Pub. EE-120. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.

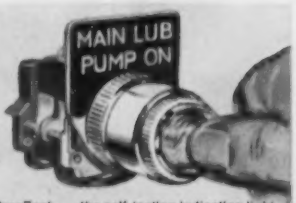
These pushbuttons may be flush type, extended type or with mushroom heads . . . in a wide range of colors for quick control identification. Standard, large, and jumbo size legend plates fit every type of operator and indicating light in the entire line.

A maintained-contact pushbutton assembly that saves more than its entire cost by installation savings. New attachment with its pushbuttons mount in minutes; no fussy adjustments. Neither alignment nor spacing of units is critical. Pushbuttons will not bind or stick; always operate perfectly.

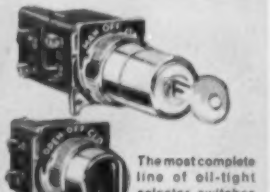
CUTLER-HAMMER
☆ ☆ ☆
MOTOR CONTROL
C-H



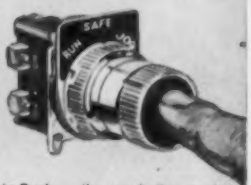
The C-H one-hole mounting oil-tight indicating lights with new wide-visibility lenses are the most visible from all angles by actual light meter tests. Available in either transformer or resistor types. Lenses offered in six different colors.



PresTest . . . the self-testing indicating light. Vital to safety and proper use of machines, particularly in automation. PresTest now permits instant proof light is NOT off because of burned-out bulb. Merely pressing on the light lens disconnects bulb from its normal circuit and checks it on a test power supply. Resistor and transformer types available.



The most complete line of oil-tight selector switches on the market. Key or knob operated; two or three position. Positions may maintain contact or have spring return. Three standard contact blocks provide a wide range of circuit combinations with the use of just a single block. Unlimited circuitry by adding blocks.



Roto-Push . . . the one-button control station. One Roto-Push can provide all the control functions for which two or three separate pushbuttons would be used normally. Available in a wide range of selector and button operators, Roto-Push simplifies panel design and saves installation time to cut costs. Improves machine-operator efficiency.

ELECTRICAL CONSTRUCTION AND MAINTENANCE

56th Year — NOVEMBER • 1956

Research on Raceways

Modern electrical systems are requiring more rigorous engineering and, consequently, long established Code rules are often challenged in these times. Uncomfortable as the process may be to those dedicated men who carry the heavy responsibilities involved in Code making and enforcement, such questions actually are reflections of the abundant health and growth of the industry and its evolving technology.

Questions bearing on such fundamentals as raceway fill inspired the Committee on Steel Electrical Raceways of American Iron and Steel Institute to conduct an investigation through Underwriters Laboratories. The resulting "Fact Finding Report on Steel Raceway Fill" now provides the industry with a wealth of scientific experimental data for the appraisal of present rules and the formulation of future requirements.

There are few surprises in the report. It was found that 40% fill is a practical working limit, which is what the Code allows. It was found that 50% fill could be made if special care is exercised, which the Code permits for rewiring existing raceways. The study verified the rules requiring derating of conductor capacity when there are more than three conductors in a raceway. But no basis was found for restricting the number of conductors in a single raceway if appropriate derating factors are applied.

For the National Electrical Code Committee, a Technical Subcommittee will, on the basis of the Report, recommend appropriate revisions:

- That no limitation be placed on the number of conductors in a single raceway.
- That the only restriction be a maximum of 40% fill.
- That derating factors be 80% for 4 to 6 conductors, 70% for 7 to 24 conductors, 60% for 25 to 42 conductors, and 50% for 43 conductors and over.

The methodical experimental background of the proposals and the fact that they are conservative, simple and sound should enlist wide industry support for their inclusion in the Code at an early date, possibly by means of an Interim Amendment.

The Steel Electrical Raceway Committee of AISI, the U.L., and the able people who planned and carried out the extensive tests, have made a constructive contribution to the basic factual data of the industry. It will provide, together with the combined experience of all industry groups, more certain foundations for the consolidation and continued development of sound, practical safety standards.

Wm. T. Stuart

We aim to please... *you!*

Bill O'Donnell and Bill Masucci are Counter-Salesmen at Graybar, Long Island City, New York. Each of these men, representative of Graybar people coast to coast, is literally in business for himself – for Graybar is wholly owned by its operating and retired personnel.

And that's why, with Graybar, aiming to please our customers has special meaning. Whether it's an over-the-counter transaction, a regular call from a Graybar Representative or in working with a Graybar Specialist on a major electrical installation – you're dealing with men who take a special pride in rendering an extra "something" beyond the ordinary. A Graybar man's personal interest in his company and his job is reflected in how he can best serve *you*, his customer, at all times.

Remember! Try us the next time you need anything electrical. In the more than 130 Graybar locations, our service is to provide what you want, when and where you want it.

We'll welcome your inquiry, large or small.

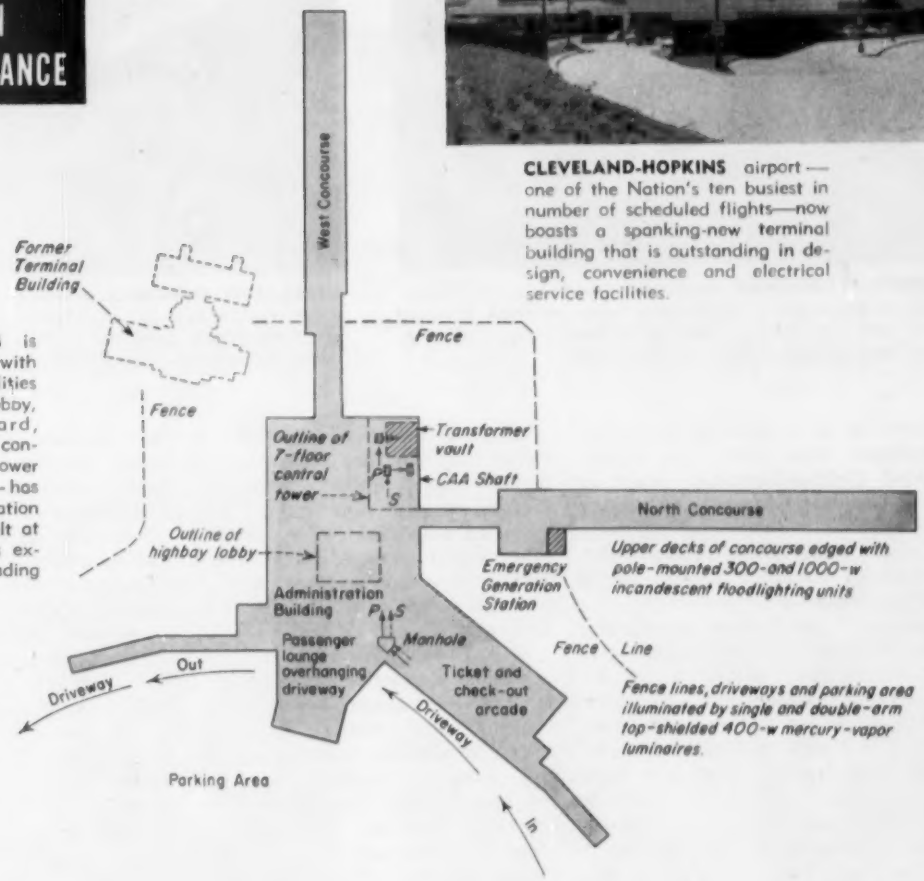
633-411

CALL **GraybaR** FIRST FOR

Everything Electrical GraybaR

GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK, IN OVER 130 PRINCIPAL CITIES

CLEVELAND-HOPKINS airport — one of the Nation's ten busiest in number of scheduled flights—now boasts a spanking-new terminal building that is outstanding in design, convenience and electrical service facilities.



TERMINAL BUILDING is functionally planned with ticket and baggage facilities on first floor; main lobby, flight-information board, lounge and majority of concessions above. Control tower — 7 floors in height — has glass-enclosed CAA station at top; transformer vault at base. Concourse wings extend outwards to loading gates.

POWER AND LIGHT

. . . for a Modern Airport

Impressive air terminal in Cleveland, Ohio, features numerous lighting innovations, an electronic flight-information board, extensive high-voltage underground distribution system, emergency standby generation station and progressive 7-story control tower. Multiple-contract electrical installation was engineered by consultants P. C. Mehnert and C. K. Reid.

MOST recent airport to be rated as "one of America's finest" is nearing completion in Cleveland, Ohio. Representing an expansion and rebuilding investment of over $8-million, this air terminal now possesses an outstanding administration and operations building, praiseworthy interior and exterior lighting, a top-flight electrical installation, plus numerous plane and passenger service facilities which are second to none.

Escalators carry passengers from an extensive check-in and ticket

SWEEPING DRIVEWAY, underpassing spacious waiting lounge, permits passengers to directly enter ticket and check-in arcade (at right) then take escalator up to main lobby, restaurants and other concession areas on second floor.

UPPER-LEVEL ENTRANCE to waiting room is through glass doors surmounted by cove-lighted metal-and-fluorescent-enameled Zodiac signs and brushed-aluminum canopy patterned by recessed-and-glass-diffused fluorescent lamps.

foyer up to a high-bay luminous-ceilinged main lobby. An illuminated flight-information board is kept constantly accurate by remote control dials and pushbuttons. Elevators carry operations personnel up through a 7-floor control tower. Beneath the building power and signal distribution systems are routed through duct banks and walk-through utility tunnels. Emergency generators and automatic transfer switches are provided to insure continuity of light and power in the event that both incoming high-voltage services are simultaneously interrupted. Correct time, indicated on numerous self-regulating clocks throughout the terminal, is monitored by a synchronizing master clock which in turn receives Arlington time signals directly via separate radio antenna and coaxial lead-in; and wide-coverage low-decibel dissemination of flight announcements and music is obtained via numerous closely-spaced ceiling-recessed 8-in. permanent-magnet high-quality loud speakers.

One of many interesting interior lighting installations is to be found in the 90-by-70-ft high-bay central section of the main lobby, where an over-all eggcrate-louvered ceiling shields continuous rows of slimline lamps operating at 200-ma. Eggcrate cells are 3-by-3-by-3-in., giving 45-degree shielding, while rows of lamps are on 2-ft centers, surface-mounted beneath a plaster ceiling suspended 3 ft above the cellular panels. Alternate rows are on alternate circuits so that 2-level illumination may be obtained when desired.

On three sides of this high-bay section the illumination pattern is varied through the installation of recessed low-brightness glass-panelled 4-by-4-ft luminaires, each equipped with eight 40-w 3500-degree white fluorescent lamps which are likewise twin-circuited to permit the obtainment of 2-level illumination.

Still other interior areas (such as various concessions, lunch counters and newsstands, dining room, cocktail and waiting lounges, offices, concourses, ticket counters and baggage station) combine ornamental with functional objectives through the utilization of numerous cove and valance treatments, louvers and diffusing glass panels, recessed spot and floodlights, edge and backlighted signs, highlighted displays and a variety of colored lamps. Many of these modern lighting ideas can be noted in accompanying illustrations.

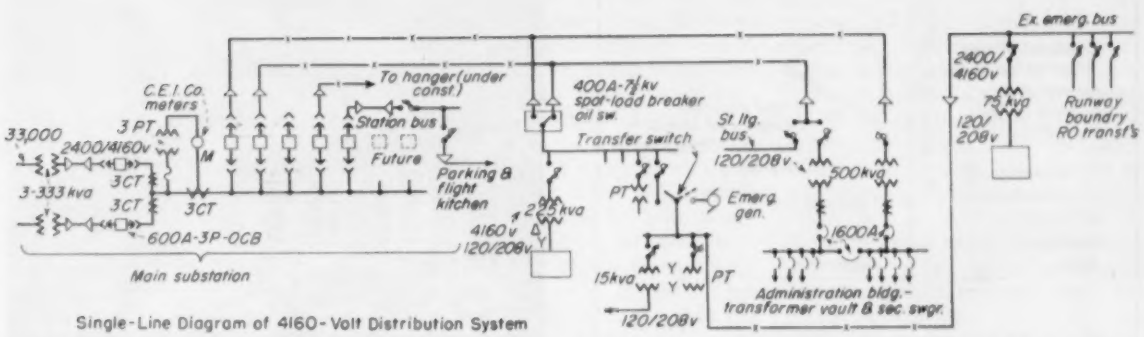
Exterior lighting (in addition to tower beacon, boundary, runway and taxi strip markers) illuminates approaches and marquees, driveways and walks, loading aprons and spectator decks, parking and service areas.

Floodlighting of aprons and decks provides for both low- and high-level illumination through the use of 300- and 1000-watt PS lamps contained in clear-lensed Alzak reflectors; one low- and two high-level units generally being grouped on a single bracketed standard. Standards (also used to support airlines' radio aerials) are spaced 40 ft apart atop both sides of all plane-gate concourses; are wired with neoprene-jacketed cables extending through furred space beneath over-hanging decks, and are also base-equipped with weatherproof receptacles for incidental power requirements.

Lighting of approaches and drive areas is by means of JHI 400-watt color-corrected mercury lamps in Holophane-refractor OV-20 luminaires supported by ornamental standards. Distribution pattern of light is medium-width asymmetrical, with reflectors hooded to prevent upward glare. Units are staggered between two underground series circuits, served through protective relays from 25-kva 2400-volt single-phase 6.6-amp constant-current transformers gang-located in the administration building's substation. Standards are round tapered 27-ft monotubes with 6-ft upsweeping brackets, transformer bases and concrete foundation piers. Control is by means of astronomic time switches.

Power Received at 33-kv

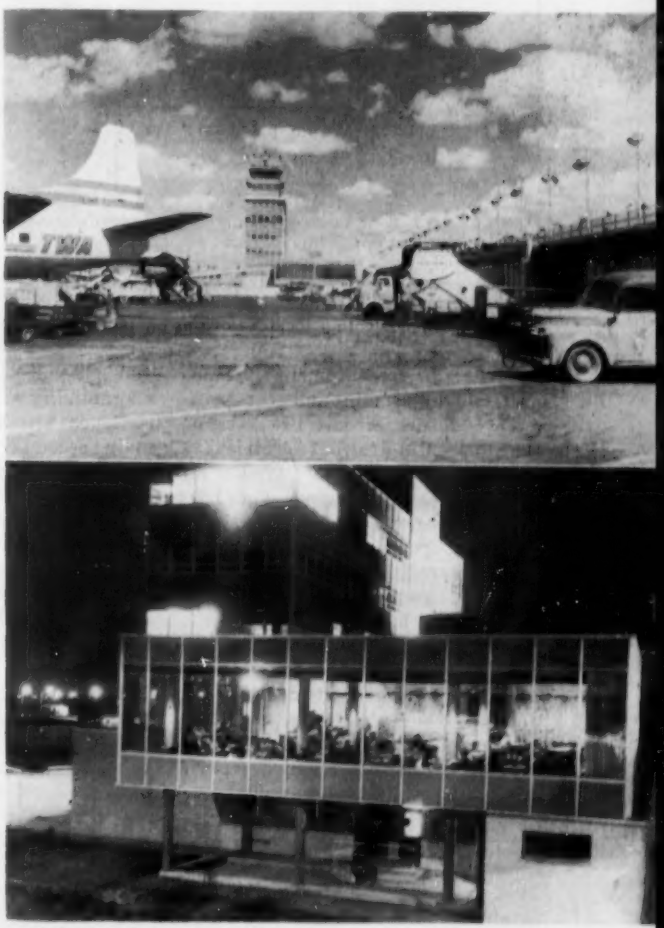
Primary power at 33-kv is delivered to the airport's outdoor pad-mounted substation, which is located just inside the field's boundary fence and consists of two 1000-kva transformers. There current is stepped to 2400/4160 volts, delivered to an elevated double-bus structure, then carried into a main switchhouse via twin 3/c VCL cables in underground concrete ducts. An automatic switch is provided to shift the entire electrical load to either transformer in the event of a partial primary outage, while spare underground ducts have been installed to permit future substation-switchhouse expansion and connection when necessary in the future.



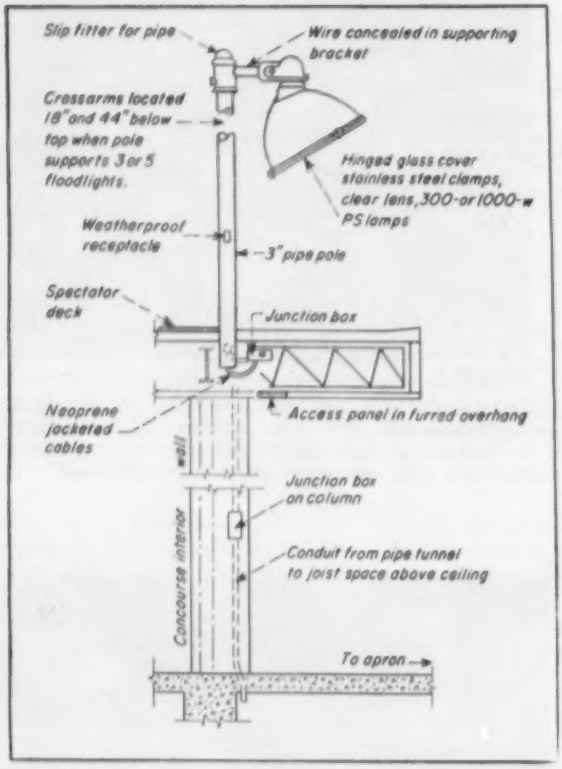
Single-Line Diagram of 4160-Volt Distribution System

PRIMARY SERVICE is obtained through dual feeders at remote substation where it is initially transformed from 33- to 4.16-kv for underground distribution to secondary vault in administration building. Independent generator for emergency use and an automatic transfer switch is also provided to insure electrical continuity for CAA control, field lighting and other vital operations. Manholes along route of underground distribution system are 2-compartment units, with signal wiring in separate vault.

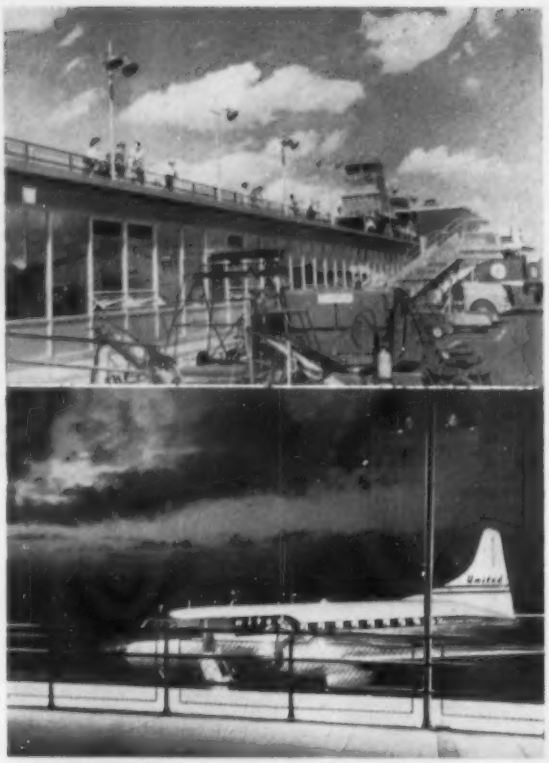
FLIGHT BOARD—an outstanding feature of the central hi-bay cellular-ceilinged lobby—presents all pertinent information through the mediums of plainly-legible lighted nameplates and numerals. Operating attendants receive up-to-the-minute flight facts via phone, teletypewriters and transcribers, then make indicated changes immediately by dialing the latest statistics on a remote-control panel.



CONTROL TOWER, rising 90 feet above ground level, is topped by CAA station that has both floor and ceiling grid of close-spaced power, phone and communication system outlets. Glass-enclosed restaurant and cocktail lounge at second-floor level combines inviting decor, attractive lighting and interesting view of runways and loading aprons for enjoyment of patrons.


Slip fitter for pipe
Wire concealed in supporting bracket
Crossarms located 18" and 44" below top when pole supports 3 or 5 floodlights.
Hinged glass cover stainless steel clamps, clear lens, 300- or 1000-w PS lamps
Weatherproof receptacle
3" pipe pole
Spectator deck
Junction box
Neoprene jacketed cables
Access panel in furred overhang
wall
Junction box on column
Concourse interior
Conduit from pipe tunnel to joist space above ceiling
To apron

FLOODLIGHTS along observation deck are generally grouped in three; one low- and 2 high-output units per pole. Standards (many of which are fitted with weatherproof receptacles for incidental power requirements) are also used to support radio aerials of commercial airline companies having separate plane-to-ground communicating facilities at this air terminal.



OBSERVATION DECK, surmounting loading concourses for their entire lengths, are equipped on both sides at 40-foot intervals by clear-lensed floodlight units; 300-watt lamps providing adequate general illumination at all times and 1000-watt lamps being switched on for high-level lighting of aprons during loading, unloading and plane-servicing periods.

Switchhouse equipment includes two 600-amp main and (at present) 5 feeder circuit breakers of the horizontal-drawout electrically-operated air-breaker type, all breakers being equipped for 120-volt dc solenoid closing and shunt tripping. Potential for this function is supplied by a 60-cell lead-acid pasted-plate sealed-glass storage battery and charger.

Of the five outgoing feeder circuits, two extend for ½-mile through underground ducts to a secondary substation located in the airport's new administration building, two others serve fire pumps and electrical demands in a new 1400-ft hanger, while the remaining feeder is connected to a switchhouse bus which in turn serves a bank of constant-current transformers and one 10-kva unit that provides 120/240 power for switchhouse lighting, unit heaters and the battery charger just mentioned.

In the administration building's substation, two 500-kva oil-insulated self-cooled transformers step current from 4160-volt delta to 120/208-volt wye, while primary magnetizing - break disconnect switches are key-interlocked with main secondary breakers to prevent opening under load. To insure continuity of utilization power at this station, secondary buses are interconnected through a 1600-amp tie breaker, thereby making it possible to serve the building's entire load from either transformer or primary feeder in the event of a partial fault. Secondary breakers and their tie are also key-interlocked to prevent paralleling of transformers.

Low voltage (120/208) switchgear (related to feeders and panels for elevator motors, kitchen appliances, public and tenant power and lighting) is located in a separate room, adjacent to the transformer vault, and is connected to transformers by means of low-reactance 4-pole enclosed busducts that pass through the intervening wall. All breakers are 600-amp draw-out units with time-delay and over-current-trip attachments.

In addition to serving secondary transformers and switchgear, the administration building's two incoming 2400/4160-volt feeders are breaker-connected directly to a series of constant-current transformers for street, field and runway lighting. These runway and field c-c transformers (as well as a 75-kva transformer related to emergency 120/208-volt lighting in and around the building) may also be served through a separate 2400/4160-volt underground feeder extending from a diesel engine-generator station.

Extensive Underground Distribution

The complete new underground duct system is an extensive one, for in addition to interconnecting primary, secondary and emergency substations, it likewise contains main circuitry for field lighting, hangers, low-voltage control, city fire alarm system, Western Union lines, CAA and telephone services. In addition, it is interconnected to all duct systems, pipe and cable tunnels that formerly served the

original (now demolished) air terminal, for it was imperative that all normal as well as emergency electrical services be continuously maintained during the transition from old to new facilities.

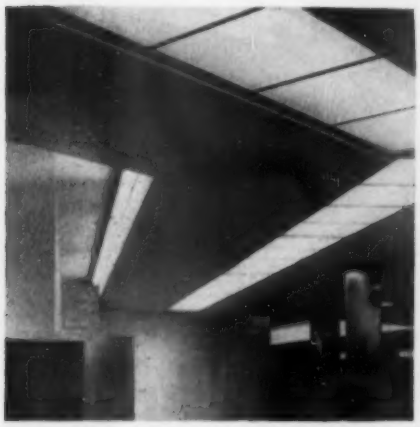
Underground high-voltage power lines and low-voltage signal circuits are installed through separate ducts and manholes, although at several key locations manholes are 2-section structures with power and signal wiring placed closely adjacent but on opposite sides of a mutual concrete barrier. Between such manholes, all power and signal ducts are run in the same concrete-encased bank, with signal ducts carried laterally as they approach manhole locations so that they enter their proper compartments with centerlines 4-ft removed from power lines. Manhole sections are variously 6- or 8-sided, dimensioned with a 6-ft width and depth, designed with flared duct entrances, and provided with cable racks, pulling eyes, copperweld ground rods and sump pits. Cable splices, located only at manhole racks, are protected by ½-in. wrappings of multi-layer asbestos tape sealed in place with sodium silicate impregnations.

In general, all wiring within the administration building, control tower and the two plane-gate concourses is 4-wire (supplying 120/208-volt current), with feeders installed from the main secondary switchboard to subdistribution and branch panelboards in rigid galvanized conduit. Horizontal runs of large feeders are generally either through tunnels or are contained in ground slabs, while vertical risers serving the 7-floor CAA tower are carried via shaftway. Support of feeders is by means of galvanized clamps or brackets which are in turn adjustably secured to lipped strut inserts bolted to tunnel or shaftway walls. All feeder conductors are type RR neoprene-jacketed.

Pull boxes larger than 18-by-18-by-8 in. are of 12-gauge seam-welded sheet steel with conduit holes cut to size by rotary saw or knockout punch (not torch cut),

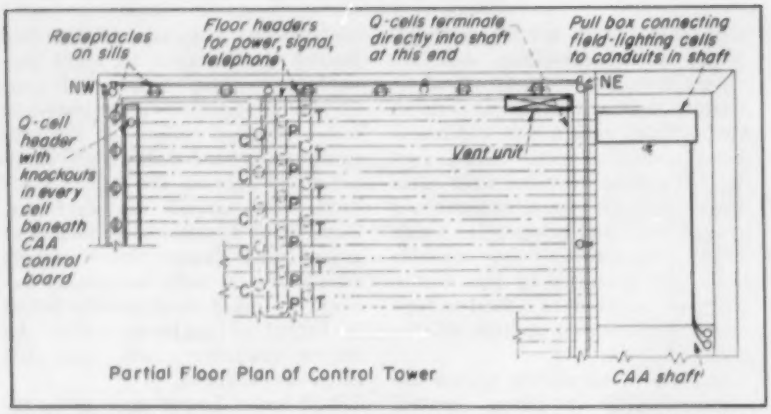
TICKET ARCADE, indirectly cove-lighted, is flanked on one side by airlines' check-in counters; on the other side by all-glass wall having numerous doors opening directly to portico-protected sidewalk bordering lower-level passenger-service driveway. Numerous recessed P-A speakers are used for paging and to disseminate flight information to waiting passengers.

AIRLINES' COUNTERS, baggage scales, wall murals and flight information boards are highlighted by parallel continuous rows of recessed fluorescent fixtures, as shown above. Baggage is conveyed through walls to loading aprons.

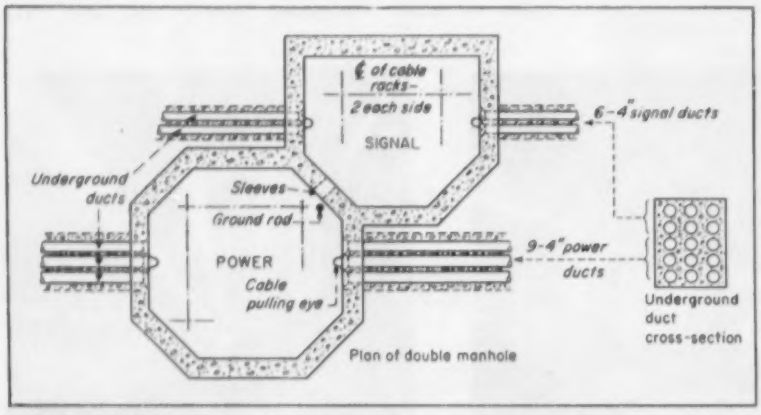


BAGGAGE RACKS and counters are also illuminated by fluorescent coves and recessed downlights that promote fast identification of bags as they are brought in from the planes. Level of illumination on bags is 65-fc.

CONCESSION AREAS surrounding the terminal's high-bay main lobby are variously illuminated by luminous ceilings, low-brightness square glass-panelled luminaries, coves and valances, edge- and back-lighted signs, highlighted displays and lamps of several colors. Dual circuiting permits variations in light levels.


Receptacles on sills
Floor headers for power, signal, telephone
O-cells terminate directly into shaft at this end
Pull box connecting field-lighting cells to conduits in shaft
NW
NE
O-cell header with knockouts in every cell beneath CAA control board
Vent unit
Partial Floor Plan of Control Tower
CAA shaft

CONTROL TOWER, with extensive wiring facilities for power, signal and telephone circuits, is liberally equipped with floor and ceiling headers, pull boxes, wireways and outlet provisions.



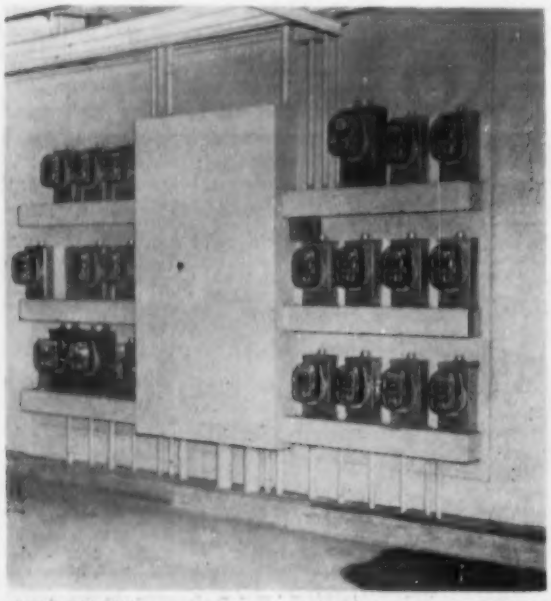
CONCRETE MANHOLES are 2-section structures with power and signal wiring placed conveniently adjacent but separated by a mutual barrier wall. Between manholes, underground ducts are grouped together and encased in concrete envelope.

and with front flanges neoprene-jacketed to insure a continuous running seal beneath cover plates. Conduits terminating at pull boxes (also at motor starters and terminals, safety switches and outlets) are secured with double locknuts, with bushings over conduit ends and neoprene washers beneath outside nuts.

In general, conduits (aggregating over 65 tons) are run exposed in shafts, tunnels and unfinished areas; concealed in offices and finished sections. Where concealed, they were first blown out with compressed air and swabbed to eliminate dirt, moisture and obstructions. And, where empty conduits were installed as spares for future use, they were also capped at both ends.

Distribution and local lighting panelboards are constructed with 3-phase mains, solid neutral terminals and thermal-magnetic circuit breakers. And, in many lighting panelboards, enclosures are sectionally bused and equipped with contactors for remote control.

Branch circuiting is 12-gauge or larger, with a common neutral conductor serving two or three lighting circuits (where permitted by NEC) and with all conductors color-coded for positive circuit identification. Circuits specifically serving concession areas and space leased by airline companies are



SUBMETERING assembly is provided to serve concession areas and space leased by airlines with facilities at airport. All other areas are check-metered for purposes of load balance.

MOTORIZED doors may be opened or closed from either side by operators of baggage trucks. By pulling overhead control cord, operator can remain on trucks while motivating door.

submetered, and they are, therefore, grouped at separate panelboards for convenient meter reading. All other areas (including public rooms, approaches, administrative and CAA offices, lobbies, ticketing space, weather bureau and field operation facilities) are check-metered by hand-instruments for the purpose of load balance.

Flexible Wiring Facilities

In offices and CAA areas, wiring for 120-volt wall and floor receptacles, as well as that for branch telephones and signal circuits, is carried in structural Q-flooring. Headers were placed in position just prior to the application of fill in order to minimize the possible damage to components, and access junction units were located at all feed, header-cell intersection, and change-of-direction points. Floor taps and outlets are limited to six per circuit, and the entire integrated steel floor mass is grounded at frequent intervals.

In concourses, where airlines' operations offices are interspersed between plane-gate lobbies, power and signal wiring is slab-contained in segregated 2-cell steel underfloor ducts having outlets on 2-ft centers.

In the 92-ft-high control tower surmounting the administration building, power and signal distribution is by means of a 7-by-4-ft vertical shaft, large-diameter riser conduits, Q-flooring, plus 4-by-6 and 6-by-12-in. wireways. At the top (7th floor) level, where flight and field control operations are centered, all Q-cells open directly into the riser shaft at one end and have knockouts in every cell at the other end (that is, the end nearest the field, beneath the broad CAA control desk); an arrangement providing the maximum of wiring flexibility.

Provisions are available for installing 208-volt unit air conditioners and ceiling-recessed radiant-glass heating panels in concession spaces and airline offices, while magnetic starters and controls as well as fused heavy-duty quick-make-break safety switches are likewise provided for all 3-phase motors in the terminal.

All of these electrical features, plus many more equally-meritorious architectural and engineering details, amply attest the combined efforts of architects Outcalt Guenther and Associates, consulting engineers Paul C. Mehnert and Charles K. Reid, and the several electrical contracting organizations that cooperated in this overall project: Polacet Electric, Harrington Electric and the Collier Construction Company.

This airport is impressive for its functional design, progressive engineering, architectural beauty, plane-servicing provisions and passenger-catering facilities alike. And, since it was constructed in close proximity to the former, smaller terminal building (subsequently raised), it was possible to progressively transfer operations from the old to the new building without interruption of convenience or efficiency. As one of America's ten busiest airports, this modernization program now places the Cleveland terminal among the country's finest.

OPAQUE LETTERS on translucent back-lighted panels clearly indicate service areas, such as buses and parking, insurance, concourses and taxi stands. Cove treatments and various in-built lighting installations also combine functionalism with esthetics. Use of colored lamps and other display techniques further add to interest of lighting plan in this modern airport terminal.

DOWNLIGHTS, recessed deeply into acoustical ceiling above passenger waiting lounge, provide adequate illumination for reading purposes and good shielding against lamp glare within field of normal vision. Cove extending continuously around perifery of this area directs fluorescent light upwards and inwards to illuminate broad central ceiling area.

Oliver F. Burnett, Kelos-Burnett Electric Co., Chicago, Ill.; Albert Frank, Eastern Electric Co., Boston, Mass.

Honorary memberships were presented by Clyde L. Chamblin (third from left) San Francisco, to George E. Davis, A. L. Davis Co., Newark, N. J.; Laurence W. Davis, Oakland, Calif.; and Harry Evans, Kansas City, Mo.

FLASHGUNS in SAN FRANCISCO

Editorial cameras catch convention personalities at the annual meetings and electrical trade exposition of the National Electrical Contractors Association held in San Francisco's Civic Auditorium, September 25-29. For the Convention Report see page 254.

By Alice McMullen and W. A. Cyr

R. Goold, Goold Electric Co., Stockton, Calif., vice president of new District 9 for California and Nevada; and R. E. Johnson, Sturgeon Electric Co., Denver, Colo., vice president for District 8.

W. B. Cline, Cline Electric Co.; Sam M. Eastham, Eastham-Orr, Inc.; Ralph F. Perkins, Coastal Electric Co., all of Corpus Christi, Texas; and R. E. Foley, Robert E. Foley Construction Corp., Syracuse, N. Y.

Virgil L. Viner, Viner Electric Co., Portland, Ore., and C. W. Mehren, Kaad Electric Co., Portland, Ore.

A. Lincoln Bush, Belmont Electric Co., New York City; Jules H. Friedland, Lightning Electric Service Co., Newark, N. J.; J. W. Frommer, L K. Comstock & Co.; H. A. Webster, T. Frederick Jackson, Inc.; and S. W. Hurowitz, Consolidated Electric Construction Co., Inc. from New York; C. J. Hervey, J. Livingston & Co.; R. E. Vierheller, St. Louis Chapter, NECA; E. O. Dorsch, E. O. Dorsch Electric Co.; Dale Moulder, St. Louis Chapter, NECA; and Richard W. Osborn, Osborn Electric Co., from St. Louis.

W. Grasle, Grasle Electric Co., Portland, Ore., W. P. Robbins, Central Electric Co., Salt Lake City; Frank Gage, Noland-Gage Electric Co., Walla Walla, Wash., and A. L. Rowe, Rowe Electric Co., Great Falls, Mont.; Visitors from the Electrical Contractors Association of England were J. G. Briggs, Chairman of the executive committee and past president; A. V. Middleton, president and L. C. Penwell, secretary-director.

David L. Stadtner, Sierra Electric Co., San Francisco, Calif., and Warren G. Smith, Smith Electric Co., San Francisco, Calif.; Ruben Kiehn, Woodland Electric Co., Woodland, Calif.; Warren E. Losh, Slater Electric Co., Folsom, Calif.; P. A. Maughan, Capitol Electric Co., Salt Lake City, Utah.

Victor P. Sarin, Sarin Electric Co., Detroit, Mich.; John Friess, Shaw Electric Co., Livonia, Mich.; A. F. Ofenstein, Motor City Electric, and Francis A. Bell, Gray Electric Co., both from Detroit, Mich. Louis Kalischer, New York City; and C. W. Moseley, R. H. Bouligny, Inc., Charlotte, N. C.

H. Y. Strader, Eastern Oklahoma Chapter, NECA; and L. T. Allen, Allen Electric Co., both from Tulsa, Okla.

Mr. and Mrs. William A. Collins, Collins Electric Co., Springfield, Mass. Mrs. Collins was selected "First Lady of the NECA Exposition."

Gus Muzzio, A. P. Muzzio, Inc., N. Arlington, N. J.; and W. G. Nordling, Nordling, Dean & Co., Inc., Summit, N. J.

H. G. Martin, Herbert G. Martin, Inc., Yonkers, N. Y. and David Cockburn, Field Electric Co., Inc., Port Chester, N. Y.

Fred Stocek, Hoffman Electric Co.; W. J. O'Brien, O'Brien Electric Co.; Albert Kahn, Monroe Electric Co.; E. E. Leasure, Jr., Monroe Electric Co.; Leonard W. Johnson, Johnson Electric Co.; Charles A. Gall, Henry Newgard & Co., all from Chicago, Ill.

John J. Downs, Rochester Chapter, NECA; Fred A. Jaeckle, Vanderlinde Electric Corp.; Alvin Mueller, Dwyer Electric Co., Inc.; Walter N. Parkes, T. H. Green Electric Co., and Louis Horacek, Horacek-Hayden, Inc., all from Rochester, N. Y.

Philip Popik, Lightmore Electric Co., Spring Valley, N. Y.; Henry Friedman, Thomas-Henry Electric Co., West Nyack, N. Y.; Charles H. Prindle, Nyack Electric Co., Nyack, N. Y. and Roy Swenson, Nehl Electric Co., Pearl River, N. Y.

SEE CONVENTION REPORT ON PAGE 254

'56 CODE REVISIONS

Analysis of the changes in the new 1956 revision of the National Electrical Code.

By B. A. McDonald

THE 1956 edition of the National Electrical Code contains many significant changes. While many of the revisions are editorial in nature, in the interests of clarity, they are very important since they will tend to minimize conflicting opinions in the field. Some of the revisions have deleted old rules. Many of the revisions contain new provisions which we have endeavored to emphasize in this report. We have omitted reference to the many editorial changes which in no way influence the intent. The intent of a rule often is obscure in the phraseology involved. In such cases we have endeavored to convey the thought of the Panel responsible for the rule.

Article 100—Definitions

The defining of terms or phrases used in the Code is very important since they establish a precise meaning and greatly influence the intent of a Code provision. Occasionally a term defined under Article 100 will conflict with the actual intent of the term as used in a specific article or section. This of course is undesirable, and unless the distinction is qualified, controversy is bound to result. The 1956 Code includes several new definitions which should clarify the intent of their use in the Code, and eliminate the differences of opinion which results when terms or phrases are not definitely defined. Fig. No. 1 illustrates the application of some of these new definitions.

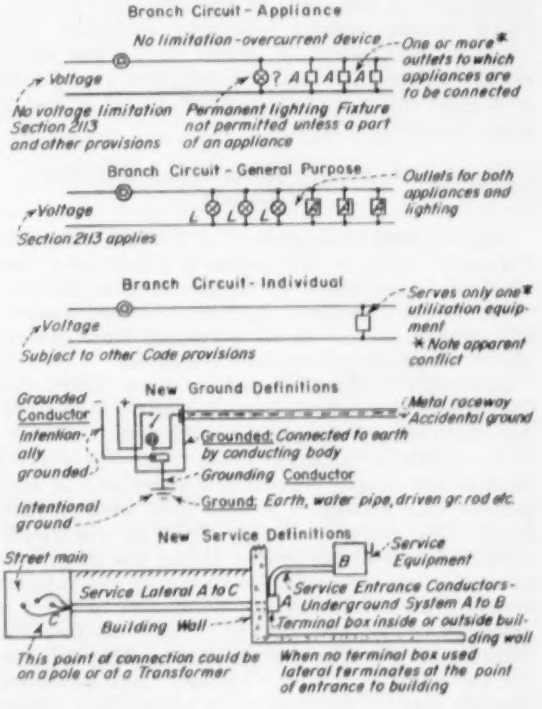
Following are typical terms which have been subject to editorial changes and which now conform with American Standard Definitions C 42. Such changes are highly desirable, especially when their use in the Code does not influence the intent of a Code provision: askarel; branch circuit; connector, pressure (solderless); enclosed; explosion-proof.

Other important changes include the following:

Building: For many years, the Code has defined a building as "A structure which stands alone or which is cut off from adjoining structures by *unpierced* fire walls." This definition was in conflict with the concept of a building as defined by Insurance Rating Bureau which recognized openings in fire walls protected by approved fire doors. The new definition will recognize such protected openings in fire walls. This new definition will tend to eliminate the conflict of opinion between the inspector and the insurance carrier. Several Code rules under Article 230 covering services are involved, such as Section 2301 which, in general, limits one set of service conductors to a building and Section 2302 which prohibits serving one building through another. Section 2321 covering service drop conductors and Section 2351-d covering service disconnects are also concerned. It is quite evident that the new definition of a building which recognizes protected openings in fire walls will influence to a considerable degree the correct application of these Code provisions.

Branch Circuits: While the new definitions, under this heading, make a distinction between an appliance, general purpose and an individual branch circuit, it is significant to note that the definition of a multi-wire branch circuit continues to remain in Section 2111 of the Code. It is also important to

Fig. No. 1 New Definitions


Branch Circuit - Appliance
No limitation - overcurrent device
One or more* outlets to which appliances are to be connected
Voltage
No voltage limitation Section 2113 and other provisions
Permanent lighting Fixture not permitted unless a part of an appliance
Branch Circuit - General Purpose
Outlets for both appliances and lighting
Voltage
Section 2113 applies
Branch Circuit - Individual
Serves only one* utilization equipment
* Note apparent conflict
Voltage
Subject to other Code provisions
New Ground Definitions
Grounded Conductor
Intentionally grounded
Metal raceway
Accidental ground
Grounded: Connected to earth by conducting body
Grounding Conductor
Ground: Earth, water pipe, driven gr. rod etc.
Intentional ground
New Service Definitions
Street main
Service Equipment
Service Lateral A to C
Service Entrance Conductors - Underground System A to B
Terminal box inside or outside building wall
Building Wall
This point of connection could be on a pole or at a Transformer
When no terminal box used lateral terminates at the point of entrance to building

note that Section 2115 of the Code covers provisions pertaining to receptacle circuits, which unquestionably appear to be appliance circuits. Such matters may be satisfied editorially in the future.

Definitions Deleted: The definition of a feeder has been deleted, undoubtedly due to a difference in opinion with respect to a new proposed definition. Since Article 220 is devoted entirely to feeders, it appears that the Code should continue to define this term, which over the years, has become a by-word in our industry. Possibly the distinction between a feeder and a sub-feeder should also be covered.

Portable Appliance: The definition of a portable appliance has also been deleted undoubtedly due to the conflicting opinions which have resulted from the old definition. In order to clarify the entire picture with respect to the term appliance, it is possible that the terms portable, stationary and fixed appliances must be precisely defined and such action may be taken in the future. As a result of this Code deletion the authority enforcing the Code has the responsibility of deciding the issue and we may expect to find diverse opinions in this respect.

Vaportight: It appears that this definition has been deleted on the basis that this term is not used in the Code. It is defined by ASA-C 42 and is used by Underwriters' Laboratories in describing fixtures suitable for use where exposed to moisture or non-combustible dusts. Since the definition has been deleted, it appears that reference to ASA-C 42 is in order as covered by the advice given in the Introduction to the Code.

Article 110—General

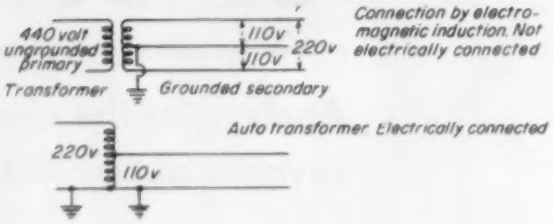
The only new addition to this article is a section which defines the scope of the article as follows: *"This Article includes provisions applicable generally in installations of electric wiring and equipment."* The sections however have been re-arranged with some editorial changes which do not appear to alter the previous intent.

Article 200—Polarity Identification of Systems and Circuits

Section 2002. Connection to Grounded System. The only change in this article is a fine print note which has been added to Section 2002 as follows: *"'Electrically connected' implies connection capable of carrying current as distinguished from connection through electro-magnetic induction."*

COMMENT: Some inspectors have interpreted the Code as not permitting the use of separate winding transformers to derive circuits from other circuits within a building unless both the derived circuits and supply systems are grounded. In support of this contention Section 2002 reads as follows: "No interior wiring shall be electrically connected to a supply system unless the latter contains, for any grounded conductor of the interior system, a corresponding conductor which is grounded." The new fine print note clarifies the meaning of "electrically connected" so that a transformer with a separate primary and secondary winding may be connected to an ungrounded system

Fig. No. 2
Section 2002: Electrically Connected

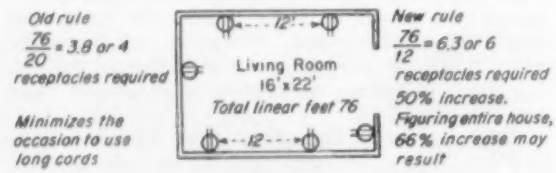


and have its secondary grounded. See Fig. No. 2. Further clarification has been made in Section 2526 which covers the grounding of isolated systems by use of the term "electrically connected."

Article 210—Branch Circuits

The most significant change in this article concerns the provisions of Section 2124-b, which covers the number of receptacle outlets required in the various rooms of a dwelling type of occupancy. According to the old Code a receptacle outlet was required for every 20 linear feet of the total distance around the room. The new provision requires a receptacle outlet for every 12 ft. An application of this new provision indicates that the number of receptacles required will be increased approximately 66%. This new provision was prompted by the recent change in Section 2203-a of the Code which increased the unit load per square feet for dwelling occupancies from 2 to 3 watts, a 50% increase. It likewise follows a trend for a higher degree of adequacy which is reflected by the requirements for services, feeders and circuits. It will also tend to minimize the hazards presented by the misuse of cords. It reflects the progress of our electrical growth and the desire of the Electrical Committee to keep abreast with such progress. See Fig. No. 3.

Fig. No 3 Section 2124-B. Receptacle Outlets in Dwellings



Another important new provision in Section 2124-b reads as follows: "Receptacles installed in or on open porches, breezeways, garages, and the like, which may supply equipment to be used by persons standing on the ground, shall be of the grounding type." This new provision originated in Panel No. 5 and was referred to Panel No. 2 as material suitable for inclusion under Article 210. Field experience during the past few years indicates that portable electric tools such as drills, saws, hedge clippers, etc. have been used extensively by residential occupants and since their metallic frames were not grounded, the personal injury hazard has become noticeable due to complaints of many who had experienced electric shock. This new provision will

provide a reliable means for grounding such types of portable equipment and since many of the manufacturers are providing tools with 3-wire cord and caps, the objective desired may be fully realized. This new provision is primarily a safeguard against the personal injury hazard and warrants your full support. It is another step towards the ultimate goal desired by many: the universal recognition of the grounding type of receptacle as a standard for all types of residential and commercial occupancies.

Article 220—Feeders

Section 2203-e. This section has been revised so that the 75% feeder demand factor does not apply to air conditioning equipment. Since this rule applies only to fixed equipment and in view of the fact that many of the residential air conditioners are provided with cords and are considered portable equipment, a question is bound to arise. Does this rule intend to cover the cord-connected air conditioner? Past field experience indicates that it should apply in view of continuous operation over long periods of time. When air conditioners are connected to a feeder, no demand factor should be applied and we believe this was the intent of the new provision.

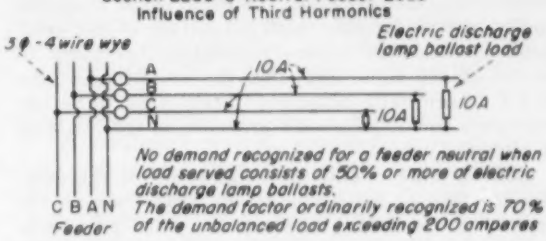
A new paragraph also has been added to Section 2203-e which reads as follows: "In adding the branch circuit loads to determine the feeder load, the smaller of two dissimilar loads may be omitted from the total where it is unlikely that both of the loads, such as an electric heating load and an air-cooling load, will serve at any time during any 24-hour period."

The comment in support of this new provision maintained that there is no engineering justification for providing feeder capacity for the sum of loads which do not operate at the same time. There was a minor objection to the 24-hour limitation as being too restrictive in such areas as Texas where wide daily ambient temperatures are encountered. While this objection was overruled, it appears that the 24-hour limitation should be seriously considered when planning an installation in some sections of our country. A possible solution to borderline cases could be a feeder, common to both types of loads, run to a transfer switch controlled by a thermostat which would select either heating or air conditioning

Section 2203-g—Neutral Feeder Load

According to the 1953 Code, this rule recognized a 70% demand factor applied to that portion of the unbalanced feeder load in excess of 200 amps. The new Code amends this provision so that it will not apply when the feeder load consists of 50% or more of electric discharge lamp ballasts. This amendment was supported by actual field experience which proved the contention that three balanced single phase fluorescent ballast loads, one on each phase to neutral of a 4-wire 3-phase circuit produced neutral currents approximating the phase current due to third harmonics developed by the ballasts. We have illustrated by Fig. No. 4 our understanding of this load characteristic which considerably alters

Fig. No. 4
Section 2203-G Neutral Feeder Load
Influence of Third Harmonics


3 φ - 4 wire wye
Electric discharge lamp ballast load
A
B
C
N
10A
10A
10A
C B A N
Feeder
No demand recognized for a feeder neutral when load served consists of 50% or more of electric discharge lamp ballasts.
The demand factor ordinarily recognized is 70% of the unbalanced load exceeding 200 amperes

our previous concept of the neutral current in a balanced 3-phase, 4-wire feeder or circuit. This factor is very important when large fluorescent lighting loads are involved, since it concerns the size of neutral conductors not only in the feeder but also the main service and the various equipment concerned. It likewise concerns the current-carrying capacity of the service or feeder conductors installed in raceways since we do have four conductors carrying current and the 80% reduction factor applies.

Article 230—Services

Section 2304-a. Size of Service Entrance Conductors. A new fine-print note has been added to this section. It reads as follows: "It is recommended that a minimum 100-amp 3-wire service be provided for all individual residences."

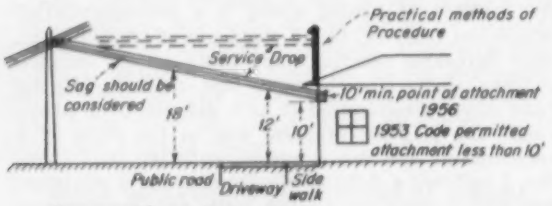
COMMENT: The 1953 Code definitely required a minimum No. 6 service with a few exceptions for very small loads where one or two branch circuits are required to serve the total load. This provision will continue to appear in the 1956 Code. The new fine print note quoted above is a recommendation which has received, by all segments of our industry, very favorable reaction; and many of our municipalities, inspection bureaus and electric utilities have already recognized it as a definite Code provision. The original proposal was in the form of a requirement and not a recommendation, but Panel No. 3 believed a definite requirement for a minimum 100-amp service to conflict with the fundamental purpose of the Code, based on minimum provisions necessary for safety, as covered by the third paragraph under the "Introduction to the Code." It is quite evident, as our residential loads continue to increase and the public becomes aware of the importance of the adequacy of their electrical systems that there will be no objection to the installation of the minimum 100-amp service. Many of our individual residential occupancies of today, which are airconditioned, heated electrically and have electrical kitchens, find this minimum 100-amp service insufficient to adequately serve such loads; and as the trend for electrical living continues to broaden in scope, we may expect that the 100-amp recommendation in the 1956 Code will become a definite requirement in the 1959 Code.

Section 2322: Clearance of Service Drop. The introductory sentence has been so reworded that it is now necessary to apply the rules of the National Electrical Safety Code when determining the clearances of service drops which operate at voltages

exceeding 600 volts. In justification of a rule by reference to another Code, the Panel called attention to the fact that a very small percentage of our overhead installations involve conductors operating in excess of 600 volts, and since the provisions of the N.E.S.C. are quite extensive, it appeared to be unnecessary to duplicate such provision in the National Electrical Code.

Section 2324. Point of Attachment to Building. Service Drops. According to the 1953 Code an exception is recognized whereby the point of attachment may be less than 10 ft provided a 12-ft clearance is obtained over a residential garage driveway and all other clearances are obtained. The 1956 Code does not recognize any attachment less than 10 ft above ground but it does continue to recognize the 12-ft clearance over residential driveways. I believe many of us will recall the confusion which results when a rule recognizes a point of attachment less than 10 ft and also requires a clearance of 10 ft over sidewalks and 12 ft over a residential garage driveway. The new rule definitely limits the point of attachment to 10 ft above ground but in many cases it will be difficult to obtain a 12-ft clearance over the residential driveway. Since ranch type dwellings with low roofs are no longer the exception, which some 20 years ago, promoted the exception to the 10-ft limitation, it becomes evident that the occasion for the exception no longer exists. As a result the generally accepted procedure of providing a point of attachment by roof brackets or periscope assemblies will continue to prevail as a practical method of obtaining the required clearances covered by the Code. See Fig. No. 5.

Fig. No. 5: Section 2324: Point of Attachment, Service Drops



Clearance: 18' over alleys, roads, 12' over Residential Garage Driveway 10' over Sidewalks

Section 2353. Connections Ahead of Disconnecting Means. Services. The 1953 Code recognizes various devices and circuits which may be connected ahead of the service disconnect. Emergency systems, fire pumps and fire alarms were so recognized. The 1956 Code will also recognize sprinkler alarms so connected. It is quite evident that the reliability of a sprinkler alarm circuit is as important as a fire alarm circuit and the definite recognition given in the 1956 Code will eliminate the opposition to such procedure which was justified by the 1953 wording.

Section 2354. Types Permitted. Service Disconnecting Means. The provisions of the 1953 Code raised a question with respect to the status of a manually operable circuit breaker equipped with a handle for closing and a pushbutton for tripping, both of which are for mechanical operation of the hand, and the tripping mechanism is entirely mechanical. This question was answered by Official Interpretation No. 403 issued in 1954 which advised that such a service disconnecting means satisfied the Code provisions. The 1956 Code has reworded this section in line with the opinion given by the official interpretation.

Section 2385. General. Services Exceeding 600 Volts. The 1953 edition of the Code, under this section, definitely requires services operating in excess of 600 volts to comply with certain provisions of Article 230 which concern services operating at 600 volts or less. Section 2351 which covers service disconnecting means and Section 2371 covering service overcurrent protection were not recognized as applying to services exceeding 600 volts. While Section 2388 intimated that this was intended, conflicting opinions resulted with respect to the use of six disconnects or six sets of overcurrent devices on services exceeding 600 volts.

The 1956 Code definitely clarifies this question by including Sections 2351 and 2371 as two additional sections which fully apply to services exceeding 600 volts.

Article 240—Overcurrent Protection

Section 2405. Ungrounded Conductors. The 1953 version of this section of the Code does not recognize the use of an individual single-pole circuit breaker to protect the ungrounded conductors of the various circuits covered when the voltage to ground exceeds 150 volts. This restriction never was intended, since it conflicts with the provisions of Section 2113 which recognizes circuits operating at voltages not exceeding 300 volts to ground. As an example, the 1953 provision would not recognize the use of single pole circuit breakers on a 3-phase, 4-wire wye, 480/277-volt circuit.

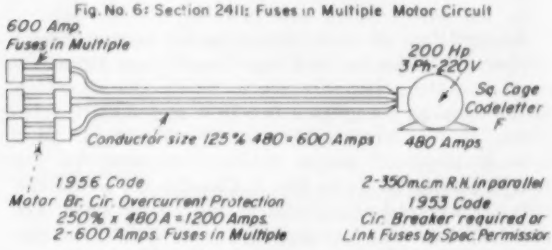
The 1956 Code definitely recognizes, by reference to Section 2113, the use of single-pole circuit breakers for the protection of the ungrounded conductors of circuits operating at 300 volts or less to ground.

Section 2409-b. Grounded Conductor. Overcurrent Protection. This provision of the 1953 Code was originally instituted in the 1925 edition of the Code. Briefly it requires 2-pole protection on a 2-wire grounded branch circuit in locations where the conditions of grounding or the likelihood of reversal of connection warrants. This old provision, born in the days when a gradual change to single pole protection for grounded circuits was progressing, has been deleted in the 1956 Code. This deletion is significant since various misconcepts have arisen with respect to its significance. A recent inquiry expresses the opinion that it applies to portable plants or moving shovels where the polarity could be reversed. Underwriters' Laboratories advise that it has been misapplied to gasoline pump circuits. While the original intent undoubtedly concerned reversal of polarity which could occur where artificial grounds of high resistance were involved, present accepted practice appears to indicate that considerations in this regard are no longer of serious consequence. This is an excellent example of a rule formulated 30 years ago when a question of correct procedure existed. Field experience in the interim indicates no need for concern, so the rule is deleted. To many of us

this old provision will be missed, not so much from a standpoint of hazard, but from the absence of confusion which has become aggravated during the past few years of its existence.

Section 2411. Fuses in Multiple. For many years the Code has recognized the use of fuses in multiple for the protection of conductors having current-carrying capacities exceeding the rated capacity of the largest approved cartridge type fuse which is 600 amps. This rule excluded the conductors of motor branch circuits. The 1956 Code has deleted this restriction, so that multiple-fusing of motor branch circuits is now recognized. This is another old rule developed in the days when multiple fusing was first considered, and a question of doubt existed with respect to motor circuits where starting currents are involved. The significance of this new provision is reflected by the example in Fig. No. 6.

Fig. No. 6: Section 2411: Fuses in Multiple Motor Circuit



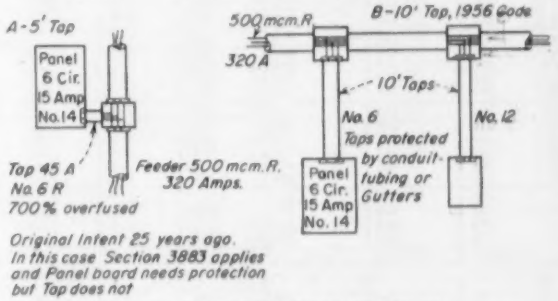
Section 2434-C. The 5-Ft Tap Rule Becomes 10-Ft. Over a period of approximately 25 years, we have become quite familiar with the 5-ft tap provisions of this Section. Without any change of the qualifying conditions, the 1956 Code increases the length to 10 ft. In support of this change Panel No. 5 offers the following comment:

"The present limitation covering taps not over 5 ft in length has been considered inadequate to accommodate some of the larger types of equipment being manufactured today. Control centers usually include a self-contained distribution bus from which a great many individual motor starters within the assemblies are supplied. Five feet is not quite long enough for these internal taps. Also taps from overhead bus ducts to panelboards will often be over 5 ft."

COMMENT: This comment is significant since it indicates a limitation with respect to intent and a few years from now, when a question arises, it may be correctly answered when we are able to recall the original intent. This change is also significant since we have doubled the distance of a tap which under some conditions of use is entirely unprotected and becomes similar to the unprotected service conductors which serve our buildings. While there may be occasions to use a 10-ft tap as covered above, it appears that the 5-ft extension should have been qualified by a fine print note similar to the supporting comment. This opinion is influenced by past experience which indicates that some folks have a tendency to take a new Code provision and so distort its application that the original intent becomes obscure. Insofar as busways are concerned, the 10-ft provision will, in many cases, permit an unprotected tap at the busway to be run to the disconnect of a motor when it is desired that such disconnects be more readily accessible than they are when installed on the busway. This would eliminate the necessity of duplicating overcurrent protection at the busway with similar protection at the disconnect. Insofar as 10-ft taps to panelboards are concerned, a lighting and appliance branch circuit type of panelboard must be supplied by conductors having overcurrent protection not in excess of 200 amps or the rating of the panelboard. In such cases an overcurrent plug-in device at the busway would be more desirable than running an unprotected 10-ft tap to an overcurrent device at the panelboard.

Field application of this new Code provision should be carefully considered so that the intent expressed is not distorted. See Fig. No. 7.

Fig. No. 7: Section 2434-C: 5' Tap becomes 10'



Original Intent 25 years ago. In this case Section 3883 applies and Panel board needs protection but Tap does not

Case B. Low ceiling. Ten foot Taps to Panels, Switches etc. The new provision will eliminate the need for the 25' Tap provision on many applications. The intent of this rule should be observed and followed.

Article 250—Grounding

There are three revisions in this article, two of which are editorial, in the interest of clarity, with no change of intent.

Section 2631. Grounding Lightning Arresters. Secondary Services. This revision eliminates the use of a separate ground conductor for the purpose of grounding a lightning arrester installed on a secondary service operating at 700 volts or less. The Code continues to recognize the grounded service conductor, or the common grounding conductor, or the service equipment grounding conductor for this purpose and Panel No. 5 agreed that there was no occasion to continue recognition of a separate grounding conductor which involved bonding.

The above brief comment in no way indicates the activity of Panel No. 5 during the past three years. Several proposed changes were rejected and an important proposal which concerns the use of gas piping systems as grounding electrodes remains on the docket for further consideration.

Article 300—General Requirements—Wiring Methods

The most significant change in this article is the addition of a new Section 3023 covering "Temporary Wiring." While the provisions are brief and concern only the matter of disconnecting temporary wiring and the use of earth returns, the Code has recognized that temporary wiring is a matter that should be covered and such recognition promotes

Table 1a – Allowable Current-Carrying Capacities of Insulated Aluminum Conductors in Amperes
Not More than Three Conductors in Raceway or Cable or Direct Burial (Based on Room Temperature of 30° C. 86° F.)

Size AWG MCM	Rubber Type R, RW, RU, RUW (12-2) / Type RH-RW Note 4a. / Thermoplastic Type T, TW	Rubber Type RH / RUH (14-2) / Type RH-RW Note 4a. / Type RHW	Thermoplastic Asbestos Type TA / Var-Cam Type V / Asbestos Var-Cam Type AVB / MI Cable / RHH†	Asbestos Var-Cam Type AVA Type AVL	Impregnated Asbestos Type AI (14-8) Type AIA	Asbestos Type A (14-8) Type AA
12	15	15	25	25	30	30
10	25	25	30	35	40	45
8	30	40	40	45	50	55
6	40	50	55	60	65	75
4	55	65	70	80	90	95
3	65	75	80	95	100	115
*2	75	90	95	105	115	130
*1	85	100	110	125	135	150
*0	100	120	125	150	160	180
*00	115	135	145	170	180	200
*000	130	155	165	195	210	225
*0000	155	180	185	215	245	270
250	170	205	215	250	270	....
300	190	230	240	275	305	....
350	210	250	260	310	335	....
400	225	270	290	335	360	....
500	260	310	330	380	405	....
600	285	340	370	425	440	....
700	310	375	395	455	455	....
750	320	385	405	470	500	....
800	330	395	415	485	520	....
900	355	425	455	....	....	....
1000	375	445	480	560	600	....
1250	405	485	530	....	....	....
1500	435	520	580	650	....	....
1750	455	545	615	....	....	....
2000	470	560	650	705	....	....
CORRECTION FACTORS, ROOM TEMPS. OVER 30° C. 86° F.						
C. F.						
40 104	.82	.88	.90	.94	.95	....
45 113	.71	.82	.85	.90	.92	....
50 122	.58	.75	.80	.87	.89	....
55 131	.41	.67	.74	.83	.86	....
60 140	....	.58	.67	.79	.83	.91
70 158	....	.35	.52	.71	.76	.87
75 167	....	....	.43	.66	.72	.86
80 176	....	....	.30	.61	.69	.84
90 194	....	....	....	.50	.61	.80
100 212	....	....	....	....	.51	.77
120 248	....	....	....	....	....	.69
140 284	....	....	....	....	....	.59

See notes, following table 2a.
*For three wire, single phase service and sub-service circuits, the allowable current-carrying capacity of RH, RH-RW, RHH and RHW aluminum conductors shall be for sizes #2-100 Amp., #1-110 Amp., #1/0-125 Amp., #2/0-150 Amp., #3/0-170 Amp. and #4/0-200 Amp.
†The current-carrying capacities for Type RHH conductors for sizes AWG 12, 10 and 8 shall be the same as designated for Type RH conductors in this Table.

the efforts of inspectors and contractors in obtaining safe installations of a temporary nature.

It is significant to note that the term "earth return" is used, especially in view of the new definition of "ground". It is quite possible that the use of this term may be taken as an inference that returns through grounded metal structures, conduits, water pipes, etc may be used. It is the opinion of the writer that this was not intended in view of the various hazards presented.

Article 310—Conductors

Section 3102. Conductor Insulation. Since the Code now defines a "bare" and a "covered" conductor, the Code recognizes these terms in the provisions of this section.

In the table covering Conductor Insulation the term "general use" has been replaced by "dry locations" and the term "general use and wet locations" has been replaced by "dry and wet locations." This change is very appropriate since the Code defines a "dry location," and we have a definite concept of its meaning. The term "general use" is not defined and could be either extended or contracted according to the concept of the authority enforcing the Code.

AVL insulated conductors have, for many years, been restricted to "wet locations." This restriction has been removed and AVL is recognized for use in both "dry and wet locations." There appears to be no justification for the former limitation.

The designation "RH, RW" has been changed to "RH-RW" strictly on the basis of editorial improvement.

The designation "SBW" covering slow-burning weatherproof insulation has been entirely deleted from this table with the following advice from the panel: "There seems to be no demand for this cable and since it is not being installed, it should be removed from the Code."

New Type RHH Insulation

Recognition of this new type of heat-resistant rubber insulation is very significant since its maximum operating temperature is 90 C, 194 F, which is the same as recognized for T, A and AVB insulations. It is limited to use in dry locations. This new development places rubber insulation in the fourth column of Table No. 1, Chapter 10, where the current-carrying capacities, in the larger sizes, are greater than now recognized for R or RH insulations. It undoubtedly will find considerable use when heat producing devices, such as recessed fixtures, are involved.

Another significant addition to this section is the recognition of the silicone-rubber insulated fixture wires, which were first recognized by Interim Amendment No. 103, effective August 17, 1955.

Section 3105. Conductors in Multiple. On the premise that conductors larger than 500,000 CM may be connected in multiple without violating the fundamental concept of safety established by the Code, this limitation has been deleted. This action endorses Official Interpretation No. 419 issued in June of 1955. Since the current-carrying capacities of conductors decrease with size, the occasion to apply this rule to conductors larger than 500,000 CM would be questionable in view of the reduced effective use of copper.

Section 3106. Current-Carrying Capacity. Aluminum Conductors. Two new tables, 1-a and 2-a have been added to Chapter 10 covering the current-carrying capacity of aluminum conductors. The old provision of Section 3106 limited such capacity to 84% of those given for the same size of copper. The new capacities will range from 78% to 83%, depending on the conductor size. A new note has also been inserted with respect to these tables, which will cover the current-carrying capacities of RH, RH-RW, RHW and RHH insulated aluminum conductors of a 3-wire single phase service and subservice. The values given are common to the various insulations and is considerably less than an average of the range from RH to RHH.

Article 334—Armored Cable

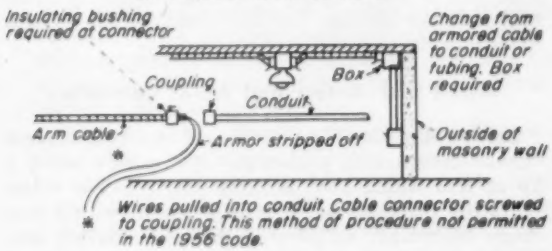
Section 3342. The use of armored cable type ACV, restricted by the 1953 Code to industrial purposes,

has been extended to include commercial purposes, subject to the previous limitations. This means that this type of armored cable may be used at voltages up to and exceeding 600 volts in a commercial occupancy as recognized by Sections 7105 and 7121, and subject to the provisions of Article 334.

Section 3347. A new sentence has been added to this section which reads as follows: "Where change is made from armored cable to another cable or raceway wiring method, an outlet box shall be installed at junction point as required by Section 3007."

This Code revision undoubtedly originated with Official Interpretation No. 430, which involved running exposed armored cable on a ceiling to a point near the wall, where the armor was stripped from the cable, and the conductors were continued without splice through about 10 ft of electric metallic tubing to a wall outlet. The connection between the cable and the raceway was made by the use of a coupling and an armored cable connector. A question concerning the accessibility of the anti-short

Fig. No. 8
Section 3347 Armored Cable


Insulating bushing required at connector
Change from armored cable to conduit or tubing. Box required
Coupling
Box
Conduit
Arm cable
Armor stripped off
Outside of masonry wall
Wires pulled into conduit. Cable connector screwed to coupling. This method of procedure not permitted in the 1956 code.

bushing required at the cable terminal also was involved. The illustration covered by Fig. No. 8 intends to clarify the new requirement which definitely prohibits the procedure outlined by O. I. No. 430.

Article 339—Type "UF" Cable

Section 3392. The last sentence of the first paragraph has been reworded so that the status of this type of cable with respect to interior wiring in wet, dry or corrosive locations has been clarified. The point at issue concerned the status of a single conductor Type UF cable.

It is also significant to note under 93391, construction specification, that the maximum size of UF cable has been changed from No. 4 to No. 4/0. This change was influenced by field experience on farm properties where questions of voltage drop or current-carrying capacity has approached the point that a No. 4 cable is unable to adequately serve the new loads common to such an occupancy.

Article 358—Cellular Concrete Floor Raceways

New Wiring Method. This article is entirely new and is woven around the concept of using the cells of a precast cellular floor slab as a raceway for conductors. Like the cellular metal floor raceway, the concrete slab serves the dual purpose of providing a structural component of a building and also as a raceway for wires. The idea however is not new, as many of you will recall, since a similar wiring method, defined as cast-in-place raceways, was recognized in the Code for many years and was deleted in the 1940 revision.

The Code provisions covering the use of this wiring method are similar to those which apply to cellular metal floor raceways. Conductor sizes are limited in size to No. 0 subject to a 40% fill in any header duct. Metal fittings such as inserts and junction boxes have been designed to serve the various needs of a wiring installation. The main distinction between the two types of cellular floor raceways concerns the grounding provisions of the Code. The metal raceway provides a low impedance path to ground while in the case of a concrete floor raceway a grounding conductor should be provided so that the various metallic fittings, and equipment connected thereto, may be properly grounded. Since cellular floor raceways involve questions concerning structural strength and the ability to retard fire, the authorities having jurisdiction should be consulted before installation.

Table 2a – Allowable Current-Carrying Capacities of Insulated Aluminum Conductors in Amperes
Single Conductor in Free Air
(Based on Room Temperature of 30° C. 86° F.)

Size AWG MCM	Rubber Type R, RW, RU, RUW (12-2) Type RH-RW Note 4a. Thermoplastic Type T, TW	Rubber Type RH RUH (14-2) Type RH-RW Note 4a. Type RHW	Thermoplastic Asbestos Type TA Var-Cam Type V Asbestos Var-Cam Type AVB MI Cable RHH†	Asbestos Var-Cam Type AVA Type AVL	Impregnated Asbestos Type AI (14-8) Type AIA	Asbestos Type A (14-8) Type AA	Slow-Burning Type SB Weatherproof Type WP
12	20	20	30	40	40	45	30
10	30	30	45	50	55	60	45
8	45	55	55	65	70	80	55
6	60	75	80	95	100	105	80
4	80	100	105	125	135	140	100
3	95	115	120	140	150	165	115
2	110	135	140	165	175	185	135
1	130	155	165	190	205	220	160
0	150	180	190	220	240	255	185
00	175	210	220	255	275	290	215
000	200	240	255	300	320	335	250
0000	230	280	300	345	370	400	290
250	255	315	330	385	415	....	320
300	290	350	375	435	460	....	360
350	330	396	415	475	510	....	400
400	355	425	450	520	555	....	435
500	405	485	515	595	635	....	490
600	455	545	585	675	720	....	560
700	500	596	645	745	795	....	615
750	515	620	670	775	825	....	640
800	535	643	695	806	855	....	670
900	580	700	750	....	....	....	725
1000	625	750	800	930	990	....	770
1250	710	855	905	....	....	....	....
1500	795	960	1020	1175	....	....	985
1750	875	1050	1125	....	....	....	....
2000	960	1150	1220	1425	....	....	1166

CORRECTION FACTORS, ROOM TEMPS. OVER 30° C. 86° F.

C.	F.							
40	104	.82	.83	.90	.94	.95	....	....
45	113	.71	.82	.85	.90	.92	....	....
50	122	.58	.75	.80	.87	.89	....	....
55	131	.41	.67	.74	.83	.86	....	....
60	140	....	.58	.67	.79	.83	.91	....
70	158	....	.35	.52	.71	.76	.87	....
75	167	....	....	.43	.66	.72	.86	....
80	176	....	....	.30	.61	.69	.84	....
90	194	....	....	....	.50	.61	.80	....
100	212	....	....	....	....	.51	.77	....
120	248	....	....	....	....	....	.69	....
140	284	....	....	....	....	....	.59	....

See notes, following table 2a.
†The current-carrying capacities for Type RHH conductors for sizes AWG 12 and 10 shall be the same as designated for Type RH conductors in this Table.

Article 364—Busways

Section 3650. Branch Circuits. According to the 1953 Code, a branch circuit connected to a busway feeder was required to have branch circuit protection in the device or plug-in connector. An exception was recognized for taps, etc., as covered by Section 2434. The 1956 Code recognizes another exception which reads as follows: "except for fixed or semi-fixed lighting fixtures, the branch circuit overcurrent device may be a part of the fixture cord cap or may be assembled to the fixtures."

This proposal came from the International Association of Electrical Inspectors, so worded that the exception would only apply to fixtures located at least 8 ft above the floor in commercial or industrial occupancies.

The second sentence of this section which reads as follows has been deleted: "Where the overcurrent device is not readily accessible, it shall be enclosed or guarded until it is electrically disconnected from the busway." This is significant since it may promote a new design of plug-in device.

Article 410—Lighting Fixtures, Etc.

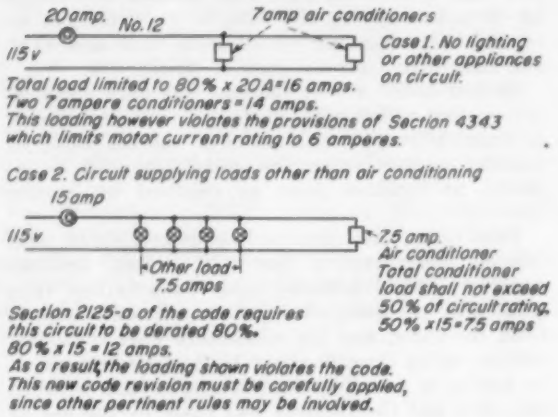
Section 4184. Fixture Mounting. This section covers special provisions for electric discharge lighting systems of 1000 volts or less and the new provision which follows applies only to such types of fixtures: "Where fixtures are to be installed on combustible low-density cellulose fiberboard, the fixtures shall be approved for this condition or they shall be mounted not less than 1½ in. from the surface of the fiberboard."

This change was influenced by actual field experience which indicated that fires do originate where fluorescent fixtures are mounted directly on highly combustible surfaces. There are two methods of satisfying the new provision; the first is to use a fixture specifically approved for mounting on a highly combustible surface, which infers U. L. approval; the second is to maintain a 1½-in. separation from the surface.

The term "low density cellulose fiberboard" may provoke a question of intent. According to the NFPA, interior wall or ceiling finishes are classified, on the basis of flame spread, from Class A to Class E, starting with the incombustible materials as Class A which are rated 0-20. Approved flameproof surface treated cellulose fiberboard comes under Class C, rated 75-175. Untreated cellulose fiberboard comes under Class D, rated 175-500. It is quite evident from the foregoing that an untreated fiberboard is very combustible. It is significant to know however that Panel No. 10 did not consider treatment to a degree where it could be considered as an exception to the new Code provision. (See page 83, NFPA No. 70, 1955.) From a standpoint of hazard, this new Code provision is very significant and merits the attention of all who are concerned.

Sections 4291-4292 and 4293. Provisions for Air-Conditioning Units. The above three new sections have been added to Article 422 as a result of Interim Amendment No. 101, effective January 1, 1955. While these provisions have become well known to many during the past two years, we believe the significance of Section 4293 warrants comment at this time. We have therefore illustrated through Fig. No. 9 the important considerations involved with this new section. See 1956 Code for the written requirements.

Fig. No. 9
Section 4293. Air-conditioning Units
Branch Circuit Requirements


20 amp.
No. 12
7 amp air conditioners
115 v
Case 1. No lighting or other appliances on circuit.
Total load limited to 80% x 20A=16 amps.
Two 7 ampere conditioners=14 amps.
This loading however violates the provisions of Section 4343 which limits motor current rating to 6 amperes.
Case 2. Circuit supplying loads other than air conditioning
15 amp
115 v
7.5 amp. Air conditioner
Total conditioner load shall not exceed 50% of circuit rating, 50% x15=7.5 amps
Other load 7.5 amps
Section 2125-a of the code requires this circuit to be derated 80%.
80% x 15 = 12 amps.
As a result, the loading shown violates the code.
This new code revision must be carefully applied, since other pertinent rules may be involved.

Article 430—Motors and Motor Controllers

Section 4322-b. This section of the Code covers "motor overcurrent protection" for motors rated 1 hp or less which are manually started. For many years the Code did not require a motor, within this range of rating, which was manually started and within sight from the starter location, to have overcurrent protection other than that afforded by the overcurrent device protecting the branch circuit conductors. The 1956 Code has been reworded so that this provision applies only when "portable" motors are concerned.

As a result of this provision, any manually started motor, within the range described, which is in a fixed position and not portable must have overcurrent protection the same as provided for automatic motors as covered by Section 4322-c.

This change was instituted by EEI on the basis that the numerous electrical fires due to fractional horsepower motors will be considerably reduced by this new provision. Here again the question of portability may arise especially in view of the deletion of the definition covering a "portable appliance." It appears however that the intent would cover any motor application in a fixed position, regardless of a cord connection or a direct connection to the branch circuit by a fixed wiring method. It is the opinion of the writer that the only motors exempted from individual protection would be strictly portable such as small vacuum cleaners, food mixers, portable drills and tools which by the very nature of their use are subject to constant attendance. Enforcement of this new Code provision should tend to reduce considerably, electrical fires due to small motor applications which past fire records indicate are a significant factor in our electrical fire losses.

Section 4328. Number of Conductors Opened by Overcurrent Device. The 1953 edition of the Code required motor-running protection devices, other than fuses and thermal cutouts, to simultaneously disconnect a sufficient number of ungrounded conductors to interrupt current flow to the motor. The 1956 Code also includes "thermal protectors" as an exception. The term "thermal protector" as applying to motors is now defined in the 1956 Code as an inherent overheating protective device responsive to motor current and temperature. The occasion for this change was prompted by the refusal of Underwriters' Laboratories to accept two single pole thermal protectors in a 3-phase motor, in view of the 1953 provisions of this section. In support of this change Panel No. 11 advises that "thermal protectors are equivalent to fuses or thermal cutouts in operation."

Sections 4371-4372-4373-4374. Remote Control Circuits. The term "remote control circuits" as used in these sections and also the title preceding the sections has been changed to read "Control Circuits" and a new definition covering a control circuit appears under Section 4371. Since a remote control circuit is defined under Article 100, we now have a distinction between the two types of control circuits, which clarifies the intent of Panel No. 11 with respect to motors and isolates the provisions of Article 725 which continues to treat on the subject of remote control circuits.

Section 4424. Circuit Overcurrent Protection. Over 600 Volts. In addition to the two existing recognized methods of protecting a motor branch circuit and feeder operating at 600 volts or more, a new method has been recognized through an additional paragraph 4424-c. This method is designated "differential protection", which is a combination of two or more sets of current transformers and a relay or relays energized from their interconnected secondaries. See Code for further details. This method of protection has been used on important installations of large motors due to the better protection which it affords. Its status with respect to the Code is now definitely established.

Article 450—Transformers and Transformer Vaults

Section 4542. Wall, Roof and Floor Construction. Transformer Vaults. This section of the Code has been revised so that fire-resistant construction equivalent to the specific constructions covered is acceptable, provided they have adequate structural strength for the conditions and a minimum fire resistance of 2½ hours according to ASTM Fire Test Standard E 119.

This provision is important since past experience shows that occasions will arise, particularly in old buildings, where a room selected for a transformer installation may have some of its walls or roof that do not fully comply with the specific requirements but do meet the new provisions for a 2½-hour minimum fire resistance. While some inspectors have in the past recognized equivalent construction on the basis of sound reasoning, this new Code provision will eliminate the questions which have arisen in this regard.

Article 500—Hazardous Locations

Section 5001. Scope. A second paragraph has been added to this section which recognizes "equipment and associated wiring approved as intrinsically safe may be installed in any hazardous location for which it is approved, and the provisions of Article 500 and 510 will not apply to such installation." The Code clarifies this provision as follows: "Intrinsically safe equipment and wiring is incapable of releasing sufficient energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture. Abnormal conditions will include accidental damage to any part of the equipment or wiring, insulation or other failure of electrical components, application of over-voltage, adjustment and maintenance operations, and similar conditions."

This Code revision was requested by the Instrument Society of America, on the basis that former Code provisions were not suitable for the correct evaluation of their equipment from a standpoint of hazard. This new provision will make it possible for U. L. to establish a standard which recognizes an inherent characteristic which distinguishes the hazard from that presented by the usual equipment. It should be noted that the new provision is contingent on "approval" which indicates that U. L. approval will be required before such types of equipment are recognized in a hazardous location.

Section 5015-c. Sealing. Class I, Division 1 and 2. A new paragraph has been added to this section, designated No. 6 and present No. 6 now becomes No. 7. It should be noted that this new provision applies to motors and generators, and that it is subject to the judgment of the authority enforcing the Code who has the responsibility of deciding a probability that liquid or condensed vapor may accumulate within motors or generators. When the probability exists and it is possible to prevent such accumulations by the arrangement of joints and conduit systems, the intent of the rule is satisfied. If however, it is not possible to prevent the entrance of liquid and where means to prevent accumulation or to permit periodic drainage are judged necessary, such means shall be provided at the time of manufacture and shall be deemed part of the machine.

This new provision is important since it definitely recognizes a possible field condition that may be satisfied only when a motor or a generator is so designed and built to eliminate the occasion for preventive field measures. This type of a rule however places the inspector in a perplexing position, since he alone must decide a question which concerns a probability and the distinction between what is or is not possible. On a new installation, it is difficult to decide such questions until actual field experience indicates the correct procedure to be followed, and then the inspector finds himself in a position where he may find it necessary to condemn the existing motor installation and require a replacement with a new motor designed to satisfy the existing condition. Such action would be a reflection on the electrical wiring design engineer who must explain to his client the occasion for the considerable ex-

facture and shall be deemed an integral part of the

TABLE 18-a

Multiplying Factors for Converting D.C. Resistance to 60 cycle A.C. Resistance

Size	Multiplying Factor			
	For Non-metallic Sheathed Cables in Air or Non-metallic Conduit		For Metallic Sheathed Cables or all Cables in Metallic Raceways	
	Copper	Aluminum	Copper	Aluminum
Up to 2 AWG	1.	1.	1.	1.
2	1.	1.	1.01	1.00
1	1.	1.	1.01	1.00
0	1.001	1.000	1.02	1.00
00	1.001	1.001	1.03	1.00
000	1.002	1.001	1.04	1.01
0000	1.004	1.002	1.05	1.01
250000 CM	1.005	1.002	1.06	1.02
300000 CM	1.006	1.003	1.07	1.02
350000 CM	1.009	1.004	1.08	1.03
400000 CM	1.011	1.005	1.10	1.04
500000 CM	1.018	1.007	1.13	1.06
600000 CM	1.025	1.010	1.16	1.08
700000 CM	1.034	1.013	1.19	1.11
750000 CM	1.039	1.015	1.21	1.12
800000 CM	1.044	1.017	1.22	1.14
1000000 MCM	1.067	1.026	1.30	1.19
1250000 MCM	1.102	1.040	1.41	1.27
1500000 MCM	1.142	1.058	1.53	1.36
1750000 MCM	1.185	1.079	1.67	1.46
2000000 MCM	1.233	1.100	1.82	1.56

inspector and engineer to apply a factor of safety in favor of the motor definitely designed to satisfy the condition. Otherwise we may expect controversy or a sub-standard field installation.

Section 5051. General. Class II Installations. A second paragraph has been added to this section which defines the new term "dust-ignition proof." This new term will be used in several Code rules, as for example in Section 5054 A-1, where the old provisions required fittings and boxes to be approved for Class II locations. The new provisions will require such boxes and fittings to be "dust-ignition proof." The occasion for this change is not explained in any available literature at hand so it is difficult at the moment to evaluate its significance.

A second paragraph has also been added to the fine print note which places emphasis on the fact that equipment approved for a Class I location may not be installed in a Class II location unless specifically approved for both locations. This is important since many errors have been made due to the false concept that equipment approved for a Class I location is suitable for a Class II location.

Article 510—Specific Occupancies

Section 5105. Commercial Garages, Repair and Storage. The only change in this section is a new fine print note which directs our attention to the NFPA pamphlet No. 88 for further information regarding the classification of garages. In view of the numerous types of garages which are common today, this reference is important since pamphlet No. 88 makes a distinction between the various types of storage garages, such as carports, open air parking garages etc. Such a distinction is useful in determining the correct classification of a garage occupancy.

Section 5120. Gasoline Dispensing and Service Stations. Several changes, in the interests of clarity, have been made in this section which we briefly cover as follows: 5120-b-2. The present provision of this section would require a seal on an underground conduit where it enters or leaves the 20-ft hazardous area. The 1956 Code provides that the hazardous area shall extend at least to the point of emergence of the conduit. As a result, no underground seal would be required.

Section 5120-c. A new fine-print note draws our attention to Section 5023, which indicates that conductors subject to gasoline or gasoline vapors must be protected by lead or by an approved means. U. L. lists a nylon-jacketed type TW wire which is considered suitable for such exposure.

Section 5120-e. Circuit Disconnects. This section has been revised so that any circuit leading to or through a dispensing pump or island must be controlled by a switch which will simultaneously disconnect all conductors of the circuit from the supply source. This revision clarifies the status of a circuit which does not serve any equipment on the island but feeds through the island to supply other loads such as pole standards, signs, etc. Such circuits must be controlled by a switch as described above.

Section 2120-f. Sealing. This section has been revised so that the provision for seals apply to a conduit where it enters or leaves a dispensing pump or enclosure on a dispensing island. It also clarifies the location of the seal with respect to unions, couplings, boxes or fittings and the status of cavities of enclosures in direct communication with the pump or other equipment.

While these revisions may be designated merely as "clarification of intent" their importance will be evaluated by the absence of considerable field controversy which provoked the revisions. They are very important to the inspector and the contractor who must apply such rules in the field.

Section 5135. Combustible Anesthetics. 5135-D-3. This section has been revised so that the provisions of Section 5019-B-2 concerning the maximum lamp temperature will not apply. Section 5135-d concerns ceiling-suspended surgical and other lighting fixtures located above the hazardous area of a hospital operating room. It was recommended by the Committee on Hospital Operating Rooms.

Several changes, in the interests of clarification or improved safeguard, have been made in the articles following Article 510, such as 520: Theaters, 530: Motion Picture Studios, etc. We have refrained from comment in view of their special nature and the need to apply them only arises occasionally.

Chapter 10—Table 21

The full load current in amperes for direct current motors has been revised upward in the smaller sizes of motors. This revision results from economic consideration with respect to motor design. The use of copper and iron previously used in 40 C motors has been reduced and their full load current ratings are greater than those shown in the 1953 Code. The use of 50 C motors likewise is increasing and such types of motors have full load current ratings considerably higher than a 40 C motor.

Table 22. Similar changes have been made in Table 22 which covers the full load currents of single phase alternating current motors. It therefore is important that both tables be consulted until such time as the new values become familiar.

FLOODLIGHTING A STADIUM

Design and installation of a floodlighting system for a large stadium involves careful engineering, requires broad construction know-how and skilled use of pole-installation equipment.

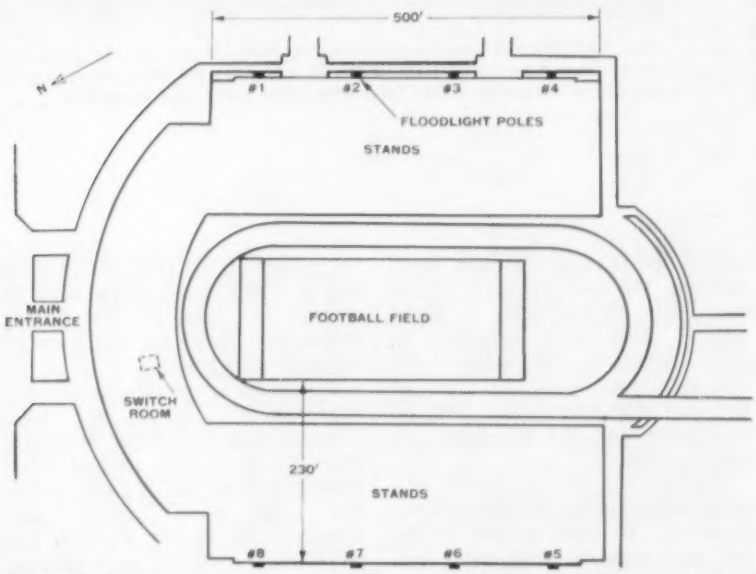
WHEN a new floodlighting system was installed at Texas Memorial Stadium, home of the University of Texas Longhorns in Austin, the Lone Star State acquired another superlative—best lighted football field in the country. In fact, when the new floodlighting system is compared with other athletic field floodlighting throughout the nation, only two ball parks—New York's Yankee Stadium and Briggs Field in Detroit—have more light.

Floodlighted 20 years after it was originally constructed, Memorial Stadium sprawls like a giant horseshoe over a 13-acre portion of the University of Texas campus, and has a playing field 360 ft long and 160 ft wide surrounded on three sides by stands capable of seating 65,500.

An average reading of footcandles at Memorial Stadium registers 112—far surpassing the minimum illumination levels used customarily in stadiums of its size. Along with this high amount of light is also a remarkable uniformity of illumination over the playing field (signified by a ratio of maximum to minimum footcandles reading of 1.53 to 1) that enables players, while spectators comfortably look on from any point in the stands, to see and handle a football with ease.

Decision to floodlight the big field last year was based on a number of factors: increased popularity of night games among Texas football fans; the need to schedule more and more night games with the university's conference rivals; and the desire to keep abreast of the trend among southern schools to floodlight football stadiums for year-round use.

Designed and laid out by Carl J. Eckhardt, the University's Director of Physical Plant, the $170,000 floodlighting job was installed by Brown & Root, Inc., Houston con-



PLAN OF FIELD shows layout of eight floodlight-pole locations and arrangements of stands.

tractors. The width of the stadium, from the back edge of one side to the back edge of the other is 582 ft. The sideline stands of the stadium, which run parallel with the playing field, are 500 ft long. Because of these dimensions, only 100-ft poles could be used to allow floodlights to be aimed onto the field without causing glare to players or spectators. At the same time, the planners felt that if tall poles were necessary, the fewer used the better. Also, for maintenance purposes, fewer poles would eliminate costly, time-consuming climbing by the stadium maintenance crew to relamp or clean the floodlights.

Like other large outdoor sports arenas, Memorial Stadium presented the need not only for providing adequate floodlighting for the players but also for spectators sitting farthest away from the playing field. This condition almost always requires several times the amount of light found satisfactory for the players. Commonly, the recommended requirement for stadiums of 30,000 capacity or over is 100 footcandles or better where the distance between spectators and the play is 100 ft or more. At Memorial, this distance between the back row onlookers and the field is 173 ft. Hence, narrow beam floodlights would be required to provide both adequate brightness and minimum glare.

With these problems in mind, the University worked out the following floodlighting system. Eight floodlight locations cover the playing field. At each location there is a concrete foundation, footed against the stadium wall, which supports two 100-ft steel poles. Each pole top is equipped with six crossarms and two service platforms. Seventy-two Crouse-Hinds FLA floodlights are grouped in rows of 12 along the crossarms.

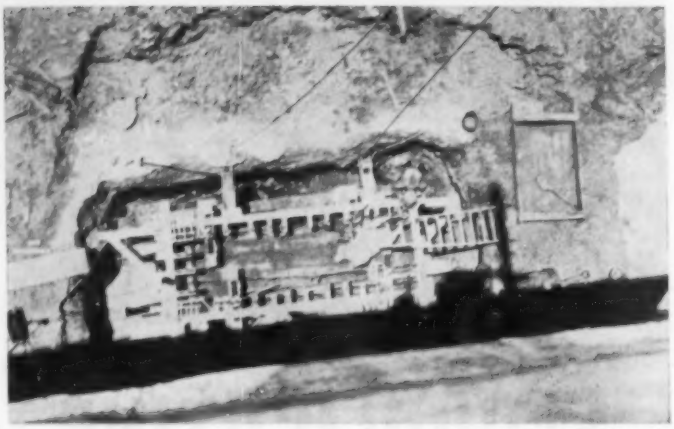
Atop the eight tower locations and consuming a total of over 1,000 kw, 576 FLA 20-degree luminaires floodlight the playing field. Fifteen 80-degree lights brighten the stadium approaches and parking areas respectively. Not pole-mounted, these latter units are fastened to the top of the outer stadium wall.

Each of the steel poles—with 36 luminaires already attached to the pole cross arms—were hoisted to the tops of the concrete piers and bolted down on special concrete forms. On the west side of the stadium, these forms rise approximately 90 ft above ground level, boosting the overall height of the west bank of floodlights to about 190 ft. Due to a difference in ground elevation, the height of the east side piers is only half that of the west side foundations. But all floodlights are 170 ft above the playing field.

Raising the 3½-ton poles into place required considerable advance planning. To raise a pole vertically and steadily, lines were run from a gin-pole located at the top of the stadium and attached above the center of the pole. Hand lines and a winch truck were used to elevate the pole to the proper height and to jockey the base of the pole into position.

Pole bases are square, measuring approximately 2 ft per side. Through four bolt holes, each pole base fits onto 10-ft anchor bolts, imbedded in all of the piers. After the poles were secured and plumbed, the spaces between the poles and foundations were grouted with a special mixture of sand, cement and water.

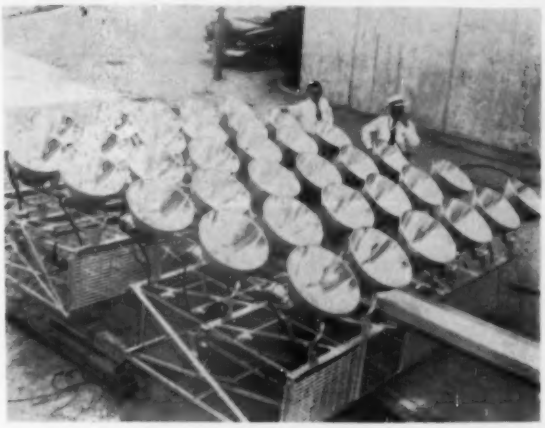
Here's the job in



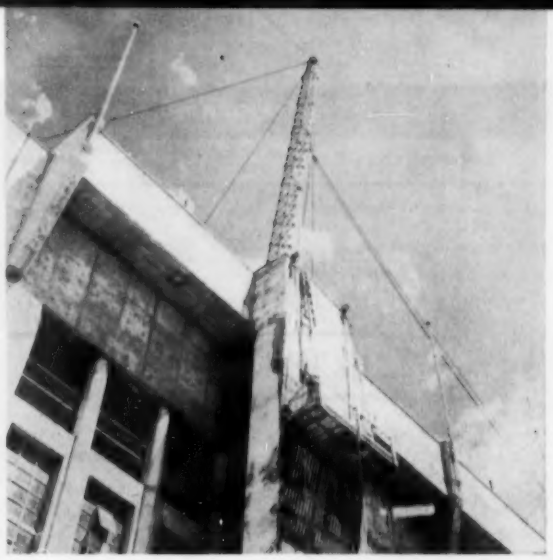
PIER FOUNDATIONS were dug and poured outside stadium wall and each pier was built up to level of top of wall to provide a base for floodlight poles. Heights of piers varied due to varying ground elevations to have all floodlights 170 ft above field.

POLE-RAISING was done by attaching line from gin-pole to steel pole at a point about three-quarters up length of pole from the base, to keep pole vertical, with floodlights up. Poles were raised with lights in position.

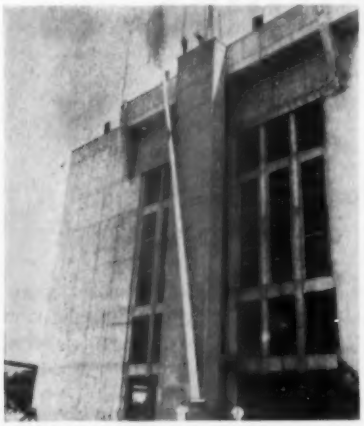
progress . . .



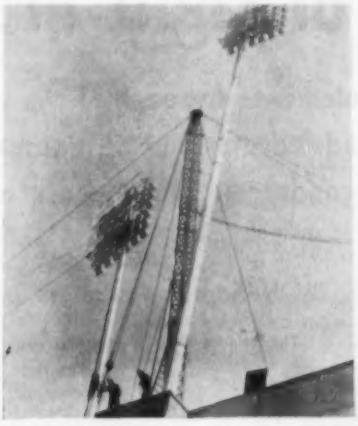
FLOODLIGHT UNITS, crossarms and service platforms were assembled on each of two poles used at each location. Floodlight assemblies—36 floodlights atop each pole—were later bolted together when two poles were mounted alongside each other on pier. Based on a plotted chart of light distribution patterns, reflectors were pre-aimed at time of assembly to poles.



GIN-POLE was mounted at top of stadium wall to lift 3½-ton poles into place atop concrete pier after concrete had set properly. Procedure was repeated for each pole.



LIFTING OPERATION involved use of hand lines and a winch truck to elevate pole to proper height and to jockey base in place in anchoring position on wall.



IN POSITION, each pole is bolted to four anchor bolts imbedded in pier, then plumbed and grouted. As shown, one pole at each location is equipped with climbing steps to afford access to platforms at floodlight assemblies, allowing maintenance of all 72 luminaires with one climb up pole.

LIGHTING TRANSFORMERS for floodlighting are mounted on shelves jutting out from inside of pier walls, hiding them from view to preserve appearance.

Each pole supports two service platforms, which—when aligned with the platforms of the adjacent pole—measure 23 ft long and 5 ft wide overall. Pre-welded and X-trussed, these platforms are bolted to the poles. To reach the platforms, one of each set of poles is equipped with conventional pole steps, allowing a service man to work on all 72 luminaires by climbing up and down a pole only once. Each pole is equipped with a rain-tight lighting panel.

A switch room for the system was constructed in the North or closed end of the stadium. A 4160-volt power service with a capacity of 1500 kw was run into the room from the utility source. Four feeder oil circuit breakers control the 4160 volts to the pole transformers.

Each floodlight unit has a corrosion-resistant aluminum base, slotted to allow at least a 90-degree swing of the light. Mounting bases are scaled for accurate aim settings.

All floodlight lamps for the system, which operate at an overvoltage of 10% are the PS-52 1500-watt, 115-volt, mogul-base type.

Connected to the primary circuit and completely self-protecting for banked secondary service, eight transformers provide low voltage (208 Y/120 volts) to each tower.

Hidden from view by the concrete piers, the transformers are supported by concrete shelves which jut out from the inner pier walls against the exterior wall of the stadium. Protected by galvanized condulets, all conduit also is hidden from the view of spectators.

FIG. 1—Resistance dimmer circuit.

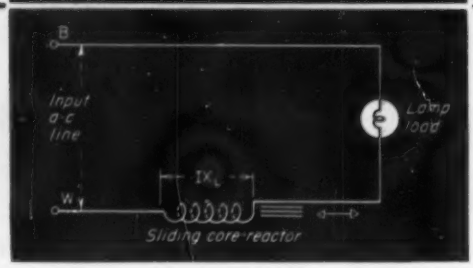


FIG. 2—Inductance dimmer circuit.

Basic Dimmers for

Control of Light Intensities

Fundamental circuit elements for each of the six basic types of dimmers are described, and features and advantages of each in controlling light output of incandescent and fluorescent lamps are discussed.

By William P. Carpenter
Chief Engineer
The Superior Electric Company
Bristol, Conn.

THE DEVELOPMENT of control equipment to change the intensity of electric sources chronologically parallels the development of these sources.

There are electrical, mechanical, and optical means of controlling light output. Mechanical and optical methods use the iris and absorption screens. Only the electrical methods will be discussed here. The most practical method of controlling light output for nearly every purpose is to control the electrical input to that light. Toward this end a number of electrical circuit elements have been used: 1) Resistance Dimmer, 2) Inductance Dimmer, 3) Electronic Tube Dimmer, 4) Adjustable Autotransformer Dimmer, 5) Saturable Core Reactor DC Controlled, 6) Magnetic Amplifier Dimmer. Each has special features for particular applications, and some are discussed separately.

Resistance Dimmers—Historically, the first electrical dimmers were water rheostats. These consisted of water in a barrel to which an electrolyte had been added to increase the conductivity. Control was achieved by adjusting the separation between a pair of electrodes in the barrel. This water rheostat was reasonably effective but totally unsuitable for general usage. One can imagine the difficulties and annoyances which are attendant to this type of dimmer. Actually, the spillage of water and the explosion of gasses could not be tolerated in commercial usage.

The metallic rheostatic dimmer was developed soon after the water barrel rheostat and has been widely accepted for years. It is still made today and offers features which prescribe its use under certain circumstances.

The resistance dimmer is connected in series in the circuit (Fig. 1). It can be seen that the voltage which appears across the lamp is equal to the line voltage less the voltage drop (IR) across the resistance dimmer. To further dim the lamp, the rheostat is adjusted by moving a contact to add more resistance to the circuit. This increases the IR drop and means there is less voltage across the lamp. However, as the lamp is dimmed, it draws less current and consequently more and more resistance must be added to continue to reduce the lamp intensity.

Two important characteristics are illustrated in the foregoing paragraph.

The resistance dimmer is sensitive to load. When it is operated at a certain designed lamp load it will have a specific dimming range. If a smaller lamp is connected to the dimmer, less current is drawn and the voltage drop in the rheostat will be less for a given setting. Consequently, the lamp size must be essentially of the wattage for which the dimmer is rated. If the lamp is smaller, the dimmer cannot reduce the lighting intensity to black-out because the lamp does not draw enough current to produce

TABLE I — Comparison of Types of Dimmers

Type	Advantages	Disadvantages
Resistance	AC-DC operation Low cost Light weight	Load sensitivity High loss Expensive to operate High heating
Inductance	Low loss	AC operation only Low power factor Noisy Load sensitive Inconvenient to operate
Electronic Tube	Great flexibility in remote control Versatility in mastering for special effects Negligible time constant	AC operation only Expensive Complicated circuitry Appreciable warm-up time
Adjustable Autotransformer Dimmer	Low loss Moderate cost Insensitive to load (good regulation) Available in a wide variety of sizes and configurations Motor operated types provide wide flexibility for large amounts of power	AC operation only The adjustment, not as fast as series tubes
Saturable Core Reactor DC Controlled	Low loss Great flexibility in remote control Versatility in mastering for special effects	AC operation only Long time constant Expensive Semi-complicated circuit Semi-load sensitive
Magnetic Amplifier	Exceedingly short time constant Great flexibility in remote control Versatility in mastering and fading for special effects Low loss Insensitive to load (good regulation)	AC operation only Slightly audible buzz

sufficient voltage drop in the dimmer. It is this voltage drop, when subtracted from the line voltage, that yields the reduced voltage required across the lamp for lower intensity operation.

It should also be noted that if one lamp is disconnected from a group of lamps in a resistance dimmer circuit, the light intensity of the other increases. Conversely, if additional lamps are added to the circuit, the light intensity decreases. Tailoring the dimmer to the load is an extreme disadvantage but is an inherent characteristic of the resistance dimmer.

The resistance dimmer, a loss type of device, produces considerable heating. The amount of heating is proportional to the current squared (I^2R) and the amount of resistance in the circuit. It can be seen that a large amount of heat is generated in the dimmer with the larger lamp loads. Since the heating is proportional to the square of the current, the wattage dissipation in the dimmer increases by a factor of four when the lamp load is doubled in wattage. High heating of resistance type dimmers necessitates the provision of good ventilation. Heating is a problem on crowded stages. The operator is uncomfortable. A fire hazard exists under some circumstances.

There are times when only the resistance type dimmer can be used. This is true in some metropolitan areas where direct current (dc) is still the only available power. Other types of dimming equipment described later do not produce a voltage change on direct current. Use of the other types on direct current means their destruction.

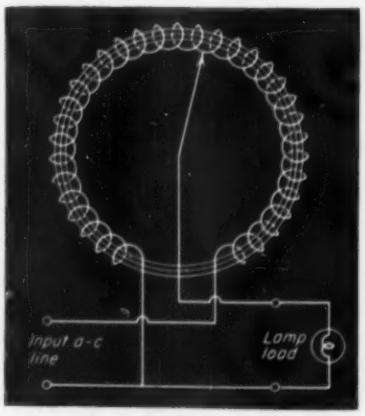


FIG. 3—Autotransformer dimmer circuit.

Inductance Type Dimmer—On ac circuits another voltage-dropping phenomenon can be employed to advantage. It is the inductance drop. Inductors for this application consist of copper coils surrounding iron magnetic cores. The voltage drop obtained is termed the inductive drop (IX) and is proportional to the current which flows through the inductor and to the inductance of the dimmer (Fig. 2). The circuit arrangement resembles that of the resistance dimmer, (Fig. 1) except that the dimming element is no longer a resistor but an inductor.

Adjustments of the inductive element can be made by sliding the core to include more or less air gap in the magnetic circuit, or by circuit taps on the coil. This type

FIG. 4—Typical 200-watt autotransformer for manual operation.

FIG. 5—Packaged dimmer with six 1000-watt circuits and 6000-watt master.

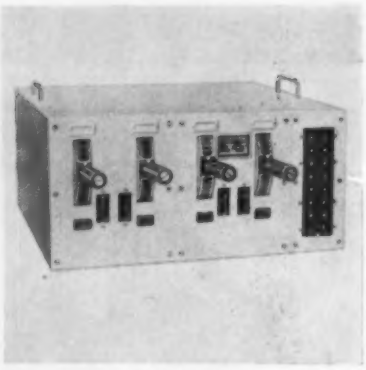


FIG. 6—Mechanically interlocked packaged dimmer with four 2500-watt ckts.

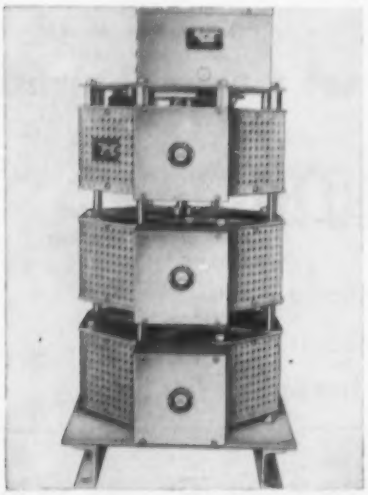


FIG. 7—Typical 15-kva motor driven autotransformer.

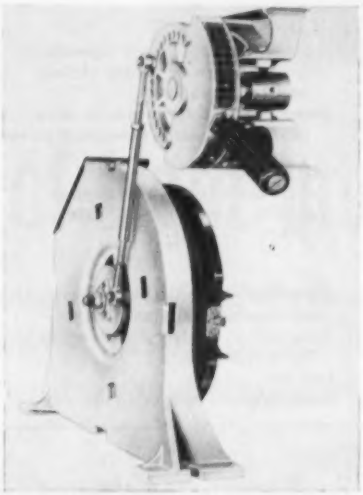


FIG. 8—Interlocking 6000-watt dimmer with handle and linkage for switchboard.

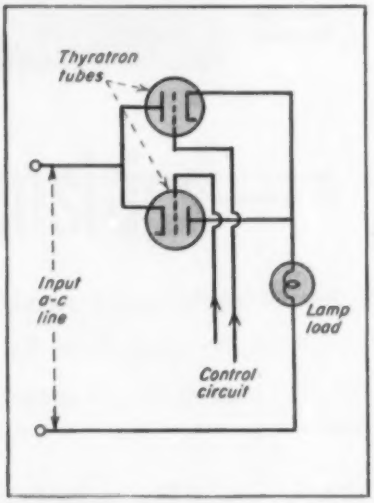


FIG. 9—Circuit for electronic tube dimmer using two Thyratron tubes.

of device is also load sensitive. The voltage drop is proportional to the current and the changes created by the use of larger or smaller loads will produce varying dimming effects. This is an extreme disadvantage, as in the resistance case, inasmuch as the dimmer will operate properly only over a rather limited load range.

The inductive dimmer is an ac device and cannot be used on dc power. Inasmuch as the core will saturate under certain operating conditions there will be annoying magnetic noises. They are not particularly convenient to operate because if the core is moved, there is a restoring force attempting to bring the core back into its neutral position. If the tapped coil method of changing the voltage is used, flickering of lights generally occurs.

Another and somewhat serious disadvantage of the inductance type dimmer is the resulting low power factor load. If necessary, this power factor can be corrected by use of capacitors. Generally, the user simply pays a penalty to his power company for having an appreciable load of this type.

The disadvantages of this type of dimmer preclude its wide acceptance, and further discussion is unwarranted.

Adjustable Autotransformer Type Dimmer—The dimmer with the widest acceptance is the adjustable autotransformer type dimmer. In its most adaptable form it consists of a cylindrical-shaped transformer iron magnetic core wound with a toroidal single layer copper winding. Each turn of this copper winding is bared and positioned so that a carbon brush can be rotated to make contact with each turn. The dimensions of the turn and the brush are such that commutating action similar to that found in a dc motor or generator is experienced. This means that the contact with the next conductor is made before it is broken from the previous conductor. This provides a perfectly smooth flickerless type of lighting control adjustable in steps of almost infinite fineness.

Since the device is essentially a single winding type of transformer, it has the characteristics of excellent regulation, high efficiency, and negligible heating without modification of the load power factor. It dims equally well all sizes of lamps from the tiniest up to the largest within its rating. With regulation exceedingly tight, no change of light intensity is experienced as additional lights are connected in or out of the circuit. It is insensitive to load.

As a device, the adjustable autotransformer dimmer requires negligible ventilation. The operating costs, important in a large dimmer installation, are kept to a minimum with the autotransformer dimmer. It regulates by transforming and not by wasting so only the actual amount of energy required for the lamp is used. One pays for only the energy used in the lamp and not for energy wasted in the dimmer.

A schematic diagram of an autotransformer dimmer is shown in Fig. 3. It is easily seen that the voltage obtained at the output terminals is determined by the number of turns included between the common terminal and the terminal which is connected to the sliding brush. This characteristic is the same as in any transformer. The voltage is proportional to the number of turns. An adjustable voltage autotransformer in one of its simpler forms is shown in Fig. 4.

Since the adjustable autotransformer will accommodate all loads up through its rating, it has been possible to standardize on certain electrical sizes to accommodate loads which are usually encountered. With standard electrical sizes, it is relatively simple to make mechanical modifications of these electrical sizes for a wide variety of applications. The autotransformer dimmer (Fig. 4) is operated by simply turning a handwheel. Many times it is desirable to locate the dimmer in an out-of-the-way point and to remotely operate the unit by means of a pushbutton control. This can be accomplished with an arrangement in which a small motor drives the dimmer (Fig. 7). Three small control leads are connected from the motor on the dimmer to the momentary contact switch. This arrangement has been found exceedingly satisfactory in control of house lights, church auditorium lighting, and similar applications. Frequently it is desirable to operate the dimmer from more than one control station. This can be easily done. In the simplest form it is only necessary to parallel additional control stations. For more elaborate control one can have priority arrangements. When an operator is at one station he takes control away from the other station. For most installations simply paralleling the switches without priority control is sufficient.

Another control modification is the positioner. This system contains a motorized adjustable transformer, a special null relay, and a miniature dimmer. The miniature dimmer is a control potentiometer of very small size arranged to operate in conjunction with the null relay so that the motorized dimmer will follow the position dictated by the remote controller. In contrast to the pushbutton control, it is necessary to observe the lights to know precisely their setting. With the positioner control the only requirement is to set the miniature dimmer lever to the intensity required. The motorized adjustable voltage transformer automatically comes to this position and stops rotation. Positioner control is extremely useful in theatrical productions where a large number of dimmers are to be controlled. The dimmers can be located remotely behind the stage, in the basement, or sometimes on the bridge above the stage. The lighting control operator locates a small console in any spot he wishes in the auditorium. From this console he controls all of the lights. It is even possible to have this console a plug-in type

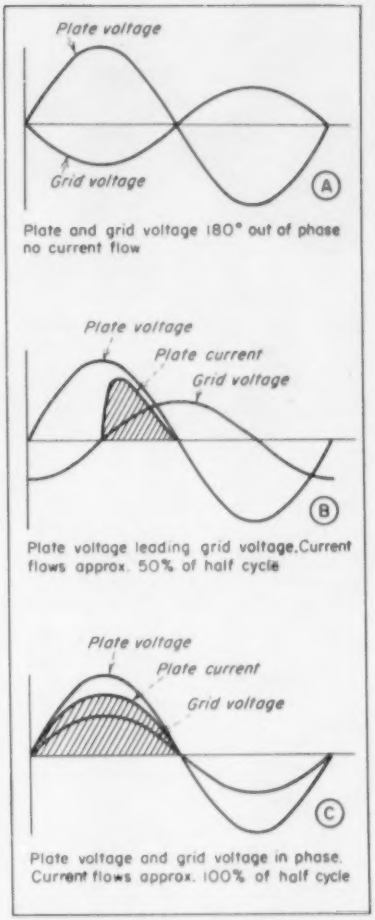


Plate voltage
Grid voltage
A
Plate and grid voltage 180° out of phase no current flow
Plate voltage
Plate current
Grid voltage
B
Plate voltage leading grid voltage. Current flows approx. 50% of half cycle
Plate voltage
Plate current
Grid voltage
C
Plate voltage and grid voltage in phase. Current flows approx. 100% of half cycle

FIG. 10—Current control characteristics of Thyratron tubes.

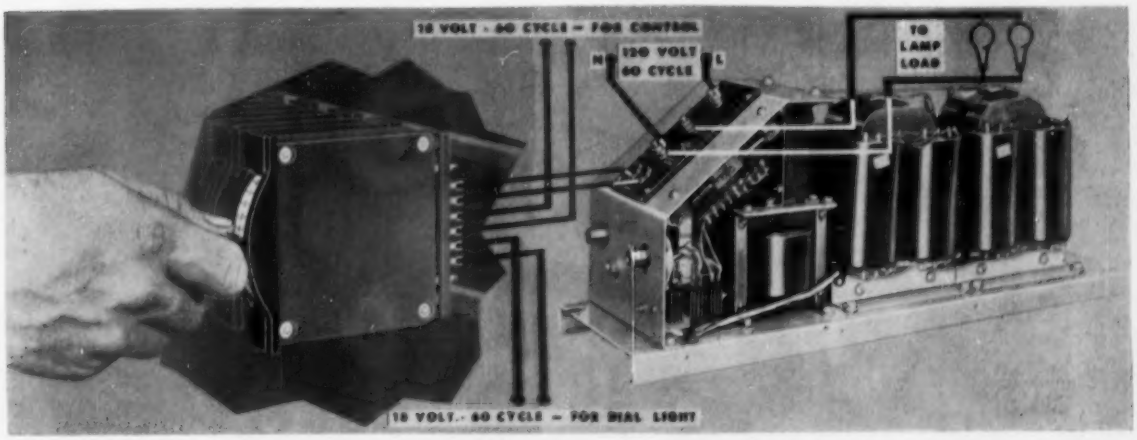


FIG. 11—Magnetic amplifier dimmer with small console.

with convenience outlets located in a number of different areas throughout the auditorium. Control may be had from the most advantageous location for the particular type of production.

An adjustable voltage autotransformer in another configuration for interlocking switchboard use, is shown in Fig. 8. The dimmer mounts with two base screws fastened through its mounting feet. Connections are made to the terminal board located either toward the front or rear of the switchboard. Adjustment is made from the handle linkage. A unique feature of this particular adjustable voltage autotransformer dimmer is that there is a planetary gear train incorporated as the drive mechanism. This is shown in the photograph as the small casting in the center with the linkage pin. This planetary drive makes it possible to conveniently locate the dimmer with respect to the operating lever in most any position on the switchboard. Before the development of this type of drive, it was usually necessary to specify the exact location of the operating lever with respect to the dimmer; or in a few cases, to restrict it to a very small area. However, when a dimmer with the planetary drive is supplied to a switchboard manufacturer, a complete diagram and tabulation is included so that he may select any dimmer handle position. By reference to his diagram and tabulation, he will know exactly where to set the planetary for proper linkage operation. This feature is of tremendous advantage and again makes it possible to stock a single dimmer for a wide variety of applications.

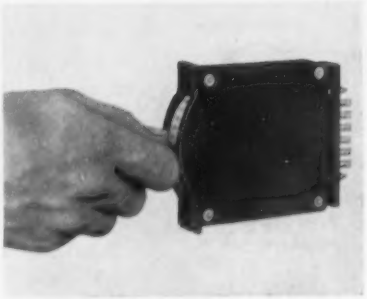


FIG. 12—Magnetic amplifier controller.

Small standard packaged switchboards are available incorporating autotransformer dimmers (Figs. 5 and 6). Illustrated in Fig. 5 are six 1000-watt dimming circuits with an electrical master ahead of all six circuits rated 6000 watts. By easy switching, any or all of these dimmers can be connected to the electrical master. The electrical master can be used separately to control an auxiliary circuit such as the house lights. These packaged switchboards are complete with indicator lights, fuse protection, switches, and output receptacles.

A packaged dimmer with four 2500-watt dimming circuits is shown in Fig. 6. In this case, an electrical master is not included, but the dimmer handles are mechanically interlocked so that any or all of them can be coupled to a common operating shaft and operated from one lever.

Packaged dimmers find wide acceptance in small theaters, amateur groups, church and other community activities. Purchase of a single packaged dimmer affords the savings resulting from a standard device over a custom-built switchboard. All the features of control, indication, and protection are incorporated in this cabinet. As requirements expand, more packaged dimmers can be added to the system.

Tube Type Dimmer—With the development of improved and more reliable electronic tubes, it is only natural that the tube should be employed as a dimming medium. Heretofore, tubes have been in conjunction with other types of dimming equipment as control elements. Now a larger gas-filled tube, the Thyratron, can be used to directly control and carry the current to lamp loads. A very elementary diagram of this type of dimmer is shown in Fig. 9.

The two Thyratrons are connected back to back so that each one may conduct during each half cycle. They are not used as rectifiers but arranged to carry both the positive and negative portions of the cycle. A gating type of control is obtained from a Thyratron when ac voltage is applied to its plate and an ac voltage of an adjustable phase is applied to its grid. As the phase angle between the voltage on the plates and the grids is adjusted, the tube can be made to conduct various length portions of the cycle. The tubes can be arranged to conduct the entire cycle and apply full voltage to the lamp load. When the grid is adjusted so that the tube conducts only a portion of the cycle (Fig. 10), the effective voltage on the lamps is reduced. With grid control the lamps can be operated at any intensity from 100% to zero light output.

Pilot control is obtained from miniature potentiometers in a manner similar to the positioner control. Some of the worthy charac-

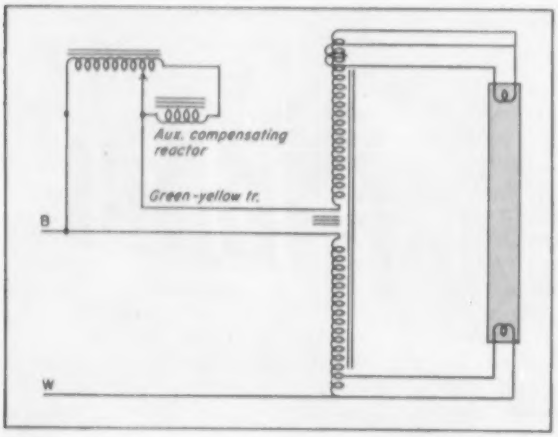


FIG. 13—Fluorescent dimming circuit—adjustable reactor.

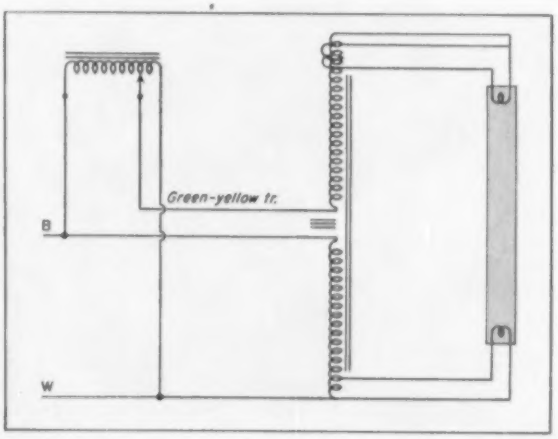


FIG. 14—Fluorescent dimming circuit—adjustable transformer.

teristics of the tube dimmer are exceeding flexibility and easy adaptation to elaborate control systems for a variety of effects. It is relatively insensitive to load but being an electronic tube device requires more maintenance than some other types of equipment. The tubes require some warm-up before the switchboard can be used and the setting may drift necessitating readjustment of the controller. Considerable heat is dissipated from the tubes. Good ventilation is a necessity.

Magnetic Amplifier Dimmer and DC Controlled Reactor—The most modern and recently announced light controller is the magnetic amplifier. In the past, some very large theater switchboards have been built using the saturable reactor. These were highly satisfactory with the exception of one serious drawback. They were slow. By slow, it is meant that an appreciable time elapsed from the movement of the pilot control to the time the lights assumed their new level. These saturable core reactors were slow because the dc coil was highly inductive and the time constant (represented by the ratio of inductance divided by resistance—L/R) was necessarily large.

The latest type of magnetic amplifier dimmer is shown in Fig. 11. With the development of newer magnetic materials and improved rectifiers a magnetic amplifier type of dimmer has been offered which is vastly improved over the saturable core reactor dimmer. The new magnetic amplifier dimmer contains various feedback and compensating windings in addition to the control windings and the power windings of a simple saturable reactor dimmer. These additional windings, together with advanced materials, make it possible to control large amounts of power with small sized control circuits. For example, one manufacturer employs a current of .010 amps in his control winding. The dimmer is controlled from a small remotely located potentiometer and this potentiometer need furnish only the 10 mils of current mentioned.

Also shown in Fig. 11 is a small console with three presets and a fader for operation of 3000 watt magnetic amplifier dimmers. Shown in Fig. 12 is a single plug-in potentiometer controller which is used in the console. This controller contains its own dial light for illuminating the scale, a colored handle to indicate the color circuit that is being controlled, and is of plug-in construction. It is designed so that it may be replaced in case of difficulty or should one wish to substitute a different colored handle controller.

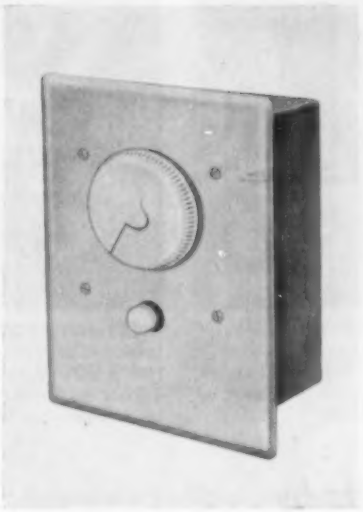


Fig. 15—Wall box dimmer for 360 watts.

It was mentioned that the console of Fig. 11 contains three presets. By presets, it is meant that there are duplicate controllers for each dimmer. A three scene preset board would have three duplicate sets of pilot controllers to set the required light level three scenes in advance. To further explain the operation, let us assume that the lights are operating at an intensity which has been dictated by preset No. 1 and at a certain cue, the light level is to go to a setting preset on preset No. 2. All that it is necessary to do is to turn the fader from preset 1 to preset 2 at a speed which is consistent with the effect one wishes to produce. There are pushbuttons on the console to enable the operator to select the presets which are to be used. For example, it is possible to fade from preset 1 to scene 3 without going through scene 2. It is also easy to fade from scene 3 back to scene 2.

The magnetic amplifier dimmer without moving parts is essentially free from maintenance and adjustment. The device requires no warm-up time and is ready to operate just as soon as the circuit is energized. Since it has compensating windings of proper design it maintains a fixed voltage for any setting regardless of load. The magnetic amplifier dimmer must operate at a high induction and it is necessary to mount the device in a location where its buzzing will not be a factor. Ordinarily, this invokes no penalty as space off stage is less valuable than on-stage space where the conventional switchboard must be mounted.

The magnetic amplifier dimmer is a very efficient device imposing no unusual ventilation requirements.

Where the ultimate is desired in dimming, the magnetic amplifier type dimmer should be used. Its features offer the most versatile control. With all its features of merit, the cost of a magnetic amplifier dimmer is quite modest and in line with other dimming schemes.

Fluorescent Lighting—In the previous discussion, mention has been made only of the incandescent lamp and the relationship of dimmers to the incandescent lamp. Fluorescent lamps have been satisfactorily dimmed and brief mention will be made of this application. Cold cathode fluorescent lamps are best dimmed simply by using an autotransformer dimmer in the input power circuit ahead of the high voltage transformer which powers the cold cathode fluorescent lamps. This dimming scheme works out well with the series connection.

Hot cathode fluorescent lamps can also be dimmed. In hot cathode fluorescent lamps, one encounters preheat or switch-start lamps, the rapid start lamps, and the instant start lamps. Without going into detail, it can be said that the rapid start lamp is the most suitable for dimming at the present stage of the art. This is true because rapid start filament-like cathodes are continually heated from separate windings in the ballast. The cathodes on the switch-start lamps are heated up only during the starting period. The cathodes on the instant-start lamps are such that the lamp initially fires or starts as a cold cathode lamp and runs as a hot cathode lamp. Without further analysis, it would seem that the rapid start lamp with its cathodes continually heated and continually emitting electrons by thermionic emission, would make the best lamp for dimming. This analysis has been proven true in practice.

(*Continued on Page 280*)

"SPECIALTIES SELL ELECTRICAL ADEQUACY," says residential contractor Jack Graham (left) of Valley Electric Co., Ramsey, N. J. He and his partner, Arthur Trifilio, (at right) have built a profitable sales campaign by arousing interest in devices whose convenience is easily understood.

ELECTRIFIED DISPLAYS in garage of model house are part of intensive effort to merchandise electrical features of Briar Hill homes. Contractor Graham asserts the key to selling electric equipment is to make consumer understand what can be accomplished with them.

Contractor Builds Profits by . . .

SELLING ELECTRICAL LIVING

Valley Electric Co, Ramsey, N. J. develops a solid sales program to obtain builder and home owner acceptance of wiring adequacy and modern equipment. Keys of the plan are cooperation of supplier and demonstration of benefits.

"I GOT tired of wiring houses at cost." From that decision contractor John Graham of Ramsey, N. J. developed a technique of selling-up residential electrical systems that has increased his work volume and, more important, has put a healthy profit column in his ledgers.

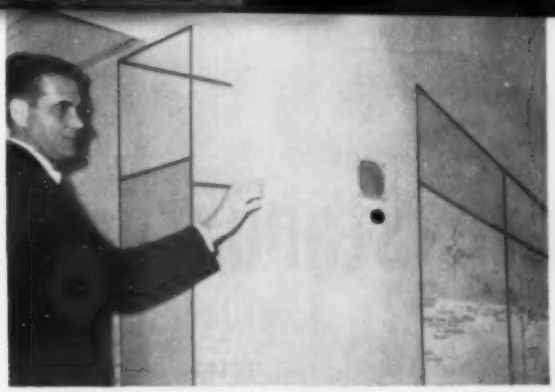
Jack and his partner, Arthur Trifilio, have operated Valley Electric Co. as specialists in residential and commercial wiring for the past seven years. Finding that profit margins remained uncomfortably low, despite an abundance of work in their northeast New Jersey community, Valley Electric's owners sought some means of improving their position. Their first course was typical of that attempted by others throughout the electrical contracting industry. So was the result.

Realizing that residential wiring systems being installed during the late 40's and early 50's were not of sufficient capacity to serve the homeowner's needs, they attempted to sell builders on adequate or even adequate-plus installations with larger services, more circuits and more outlets. Builders listened, but usually didn't buy. They explained that prospective buyers showed no great interest or understanding of the benefits of adequate wiring: its market value did not match its cost. The experiment did produce benefits, however. Some additional work was obtained, good will was promoted among Valley Electric's builder clients and, most important, the two partners learned builders wanted electrical features that could be demonstrated to the homebuyer as comfort-giving, work-saving elements of the home—features that would create a buying urge in the house-hunter.

Teamwork the Key

Just about this time Valley Electric was engaged in a small wiring job in a large nightclub-restaurant in the vicinity. During the course of the work, the owner mentioned that he would like some improved method of controlling the lighting in the large banquet hall which also served as a cocktail lounge. During private parties and weddings the area required a relatively high intensity of illumination, while a soft, subtle light was needed to afford the proper atmosphere for cocktail hour. Graham suggested dimmers for the circuits in this area. Henry Ferrando, lighting consultant for Rockland Electric & Supply Corp. of nearby Nanuet, N. Y. was called in to demonstrate the dimmers. Ferrando not only clinched the deal for the dimmers but sold the owner on relighting a substantial portion of his club. Graham and Trifilio realized a healthy profit from the additional work.

More important, however, they realized that these dimmer units, (Luxtrol) designed primarily for



DIMMER FOR GAME ROOM LIGHTS is demonstrated by salesman to customers. Both builder and electrical contractor report enthusiastic buyer response to this feature. Adjacent intercom speaker-mike and LV switch symbolize other elements of the Valley Electric campaign to sell up electrical living.

ALL-ELECTRIC KITCHEN features combination cabinet and work surface lighting as well as built-in oven, wall refrigerator and table top range units. Communication center (at right) allows two-way conversation to other living areas and front door, distribution of music or programs throughout the house.

residential applications, were an ideal type of electrical equipment to arouse the interest and enthusiasm of builders and home-buyers about better electrical living. They saw that experienced technical sales people like Ferrando could be of tremendous help in building the size of their house wiring work. Discussions with the wholesaler led to the development of a selling plan that has achieved a remarkable success for all concerned.

Selling Plan in Action

Briar Hill, a project of medium-priced estate homes in Allendale, N. J., demonstrates the effectiveness of Valley Electric's program. Builders Chuck Beir and Dick Higgins worked intensively with their architect to design three basic models incorporating the latest architectural and construction techniques providing optimum comfort at a reasonable price. But Graham felt the electrical system was hardly suitable to the concept of modern living afforded by these buildings.

Through explanation and demonstration Graham and his trade allies induced the builders to expand the scope and size of the basic electrical system. For the model house, they offered to install at cost a thoroughly modern layout including features the builders could not include in the basic equipment. These would be optional items available to the buyer at additional cost. This plan was accepted since it would make the model house more attractive and it offered the prospect of additional commissions to the builders for any extras that would be ordered.

As houses are ordered, the builders' representative discusses possible structural and decorative variations with the buyer. Contractors Graham and Trifilio then demonstrate to them the optional electrical features as a further means of increasing their living comfort in the new house. Wherever backyard barbeques, swimming pools or such items are included in the contract, he points out the additional value these living areas can deliver with outdoor lighting.

Selection of indoor lighting units is left to the buyer. The builder makes an allowance—considerably higher than the average fixture allowance—and the owner visits the wholesaler's elaborate new showroom to make his choices for each room of the house. The trained lighting specialists at Rockland Electric & Supply have been so effective in explaining the benefits of quality lighting that most buyers have exceeded their fixture allowance by 50% or more. In several cases total cost of fixtures has exceeded $350. With lighting, other electrical equipment and installation, the average cost per house has averaged over $1200.

Four Point Program

Graham suggests four steps for building a successful residential sales campaign:

1. *Team up with a wholesaler.* A responsible organization with attractive showroom and trained salesmen can afford tremendous assistance in gaining the builder's cooperation and the buyer's order.

2. *Build sales talk around items with obvious benefits.* Although the home owner will be grateful that he has adequate wiring, the *prospective* owner is more impressed by a demonstration of equipment such as Luxtrol dimmers or low-voltage switching whose benefits are highly visual. Then, when enthusiasm for electrical living has been generated, he will be receptive to discussion of system components with less apparent advantages.

3. *Start with progressive-minded builders.* Such men, inevitably industry leaders in their area, will more readily see the potential rewards in selling up electrical living. When their success has been demonstrated, other builders will be eager to participate.

4. *Be continually sales minded.* Remember, every contact with a builder or homeowner is an opportunity to build immediate or future sales. Look for new ways to merchandise electrical equipment and electrical living.

Enlarging on the last point, Graham described how electrical features of the Briar Hill homes were merchandised. Displays were set up in the garage to explain the operation and services delivered by various system components such as the dimmers, low-voltage switching, fire alarm, intercom-P.A., and electronic heating and cooling controls. Descriptive tags were hung through the house on less conspicuous equipment — switches, dimmers—to be sure they were noted by home-shoppers during their inspections. A framed Certified Adequate Wiring certificate was displayed near the electrical closet. At any opportunity, the salesman on the premises demon-

(*Continued on page* 281)

Manila Office Building Is

Lighted to Modern Standards

E. J. Mora Electric Co., Inc., Manila (P. I.) electrical contractors, works with architects and owners to specify and install modern illumination meeting IES Recommended Practice in new office building occupied by The Manila Electric Co.

By Justo N. Lopez*, *Vice-President and Chief Engineer, E. J. Mora Electric Co., Inc., Manial, P. I.*

THE lighting system in the new offices of the Manila Electric Co. meets all the requirements of good adequate lighting, viz: quantity and quality of light, color harmony, and low brightness ratio between tasks and adjacent backgrounds. Its layout was planned so the arrangements of desks and other office equipment could be changed without any need of changes in the lighting system.

In the selection of fixtures, not only their decorative qualities were taken into consideration, but also and especially the proper control and distribution of light which provides the desired lighting level. The cost of the same was not only considered from its selling cost, but also from its installation, as well as its operating and maintenance costs.

Incorporated in this modern lighting system are luminous ceilings, recessed troffers, and cove lighting.

Luminous ceilings, used in the executive offices on the second floor and in the main lobby on the ground floor, consists of Wakefield corrugated plastics, with a transmission factor of about 70%, suspended by hangers with continuous rows of 40-watt fluorescent lamps, mounted about 2-ft 6-in above the ceiling at 3-ft intervals. Some perforated acoustic baffles are integrated with the light source for noise control, thus giving the area a luminous-acoustical environment.

Recessed troffers consist of glass-shielded troffer units, designed by the illuminating engineer and manufactured by the P. I. Manufacturing Co., a local manufacturer. Each unit has three 40-watt fluorescent lamps and is equipped with directional white porcelain enamel reflectors for downward lighting and flat ribbed Corning "Alba-Lite" glass panels on the ground floor and curved ribbed Corning "Alba-Lite" glass panels on the second floor.

In the executive conference room, *indirect cove lighting* provides a soft, well diffused, general illumination, which is supplemented by two spotlights over the conference table. These are Cen-

* *Member, Illuminating Eng. Society (USA)*

RECESSED TROFFERS in continuous rows, with each four-foot unit using 3/40-watt standard cool white lamps, shielded by Corning "Alba-Lite" glass, light second floor general offices.

TROFFERS with Corning flat-ribbed glass panels provide 55 footcandles throughout collectors and cashiers offices, using porcelain enameled interior reflectors.

LUMINOUS CEILING with sound baffles light executive offices and main lobby of new Manila Electric Company office building, Manila, P. I.

tury No. 1651 100-watt Project-O-Lite units, with 1-in. apertures. The pleasing atmosphere illumination in the executive reception room is provided by various modern standard floor lamps, with diffusing bowls and shades.

The power sales and advertising offices have their furniture decorated in light two-tone grey mattel-finished to match with walls, also of a light color. This combination of light colors for walls and furniture results in a scientifically light-conditioned area, in which the brightest surface of the room is no more than three times as bright as the working surface, and this in turn no more than three times the darkest area.

The *well illuminated show windows*, which occupy almost the entire 204-ft length of the front of the building, is one very interesting feature of the illumination of this modern office building. Its general illumination is provided by four rows of three-lamp 40-w recessed Northern Hill louvered troffers, also of local manufacture. The continuous row of louvered troffers is interrupted at intervals by Smithcraft recessed spot box units with 150-watt PAR-38 projector spot lamps to provide the necessary accent lighting. These units are easily adjustable to 45 degrees from the vertical in all directions, thus making it possible to concentrate the high intensity beams of various spotlights on any particular subject.

At night, the beauty of the building is brought forth by a battery of 44 Type L-82 GE heavy duty, weatherproof, dust-tight, general purpose, flood lighting units, with Alzak-finished aluminum narrow-beam etched reflectors, strategically located on the ground and in the south wall of the old office building. These units are provided with 300-watt inside frosted incandescent lamps, which give an intensity of about 5 footcandles maintained in service over the approximately 12,300 sq ft of surface of the front, north and south facades of the building.

Initial levels of illumination averaged from 12 footcandles in stairways to 63 footcandles in general and executive offices. Other areas were as follows: corridors—18 footcandles; reception rooms—25 to 40 footcandles; conference rooms—32 footcandles; coffee room—25 footcandles; X-ray room—15 footcandles; air conditioning room—40 footcandles; power center area—22 footcandles; and toilets—13 footcandles.

The show window display has an initial level of illumination of 65 fc for the general lighting, which is increased to 200 fc with the use of the spotlights for the effective accent lighting of special displays.

This new office shows a fine example of understanding and cooperation between the owner, The Philippine American Life Insurance Co.; the occupants, The Manila Electric Co.; the architect, Mr. Gonzalo C. Balagtas, L.P.A.; and the electrical engineers of E. J. Mora Electric Co., Inc.

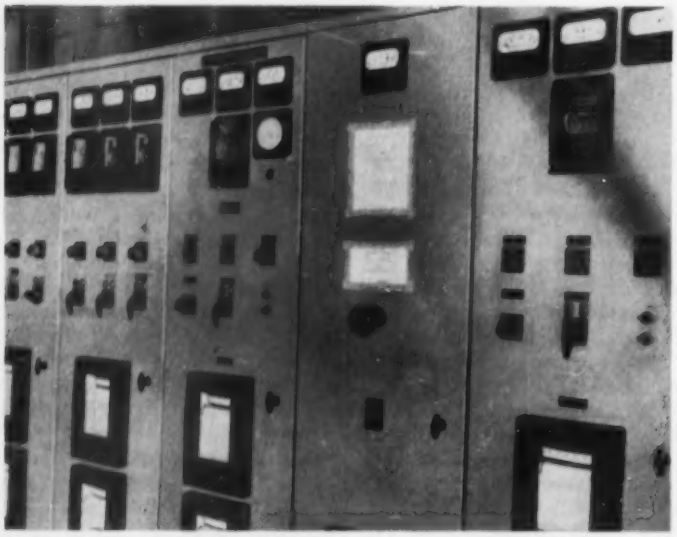
RECEPTION room on second floor is made cheerful with 40 footcandles of illumination from troffers and use of light finishes on walls and furniture.

INDIVIDUAL TROFFERS with bent Corning glass lenses light coffee room to intensity of 25 footcandles. Proper control and distribution of light were primary considerations of the job.

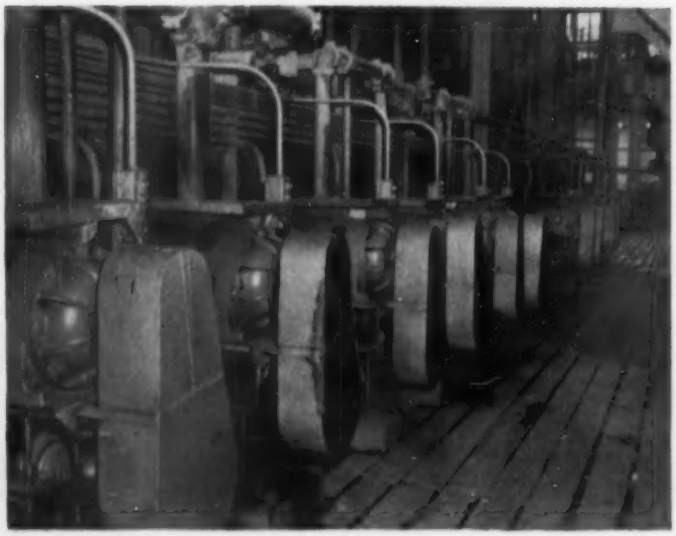
Electrical Standardization Pays Off

The Anaconda Company expanded its uranium oxide leaching plant at Grants, N. M. Electrical work included additional overhead distribution lines and installation of substations, control centers, and wiring. Standardization of drawings, circuits, and equipment reduced construction problems and simplified operation and maintenance.

By Laurence E. Baty



MAIN 2.3 KV CONTROL BOARD with graphic metering equipment.



TOP CONDUITS of this typical run to a line of motor are to pushbutton stations; lowers are for motor feeds.

THE Anaconda Company recently has completed a major enlargement of its uranium oxide leaching plant at Bluewater, near Grants, N. M.

Work included the erection of 60 additional homes in the townsite; building of recreational facilities, a new warehouse, a new change house, and additions to the general plant office; the installation of a sulfuric acid manufacturing plant, expansion of the ore treating system, and installation of additional mechanical handling equipment.

The extent of the electrical improvements can be visualized by a single comparison. Before the enlargement, two substations (totaling 1500 kva rating) were in use. After completion, there were 12 substations (not counting pole transformers) aggregating 7150 kva.

Uranium bearing ores are received at the plant, in a remote location near the continental divide, either by truck or by rail. If by rail, it is unloaded at a trestle having a 4-car capacity. After leaving the receiving bins, the ore is crushed and then given a series of treatments with reagents to remove the waste matter. The concentrate, known as "yellow cake," is sent to Atomic Energy Commission plants for conversion to metallic uranium and recovery of fissionable material.

The ores in the Colorado Plateau often contain only a low percentage of uranium oxide, sometimes in combination with vanadium pentoxide which can be recovered for use in vanadium-steel alloys. Of the yellow cake, only a small percentage is recoverable as the fissionable isotope, U-235. No commercial use has yet been found for

the stable isotopes of metallic uranium, although the medical fraternity has found some uses for certain uranium salts.

The contract with Oberg Electric Co., Salt Lake City, Utah, required the contractor to do the electrical engineering, to furnish supervision, and to make the electrical installation. Engineering was performed entirely in the field.

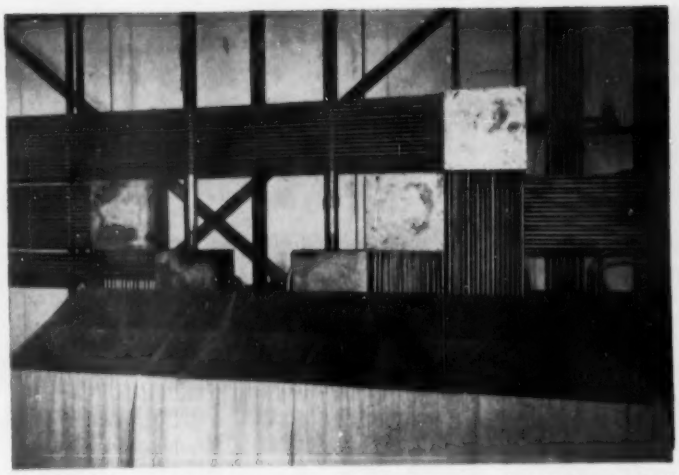
Although the plant capacity was greatly increased, provision was made for further expansion as it is warranted. In keeping with future plans, electrical engineer M. E. Dansie was liberal in providing for possible needs. As an example, every motor circuit was wired for the full wire capacity of the starter. In addition to providing for future requirements, it was felt that this standardization of ample copper in starters reduced erratic operation of thermal overload devices.

Individual conduit runs were preferred for the various items of equipment. Other than on the lighting, there was little or no intermingling of circuits. This plan was believed to contribute more to the general reliability of the wiring. In exception, junction boxes along the runs were made common to a number of circuits—a measure to permit future changes at a minimum of wiring expense.

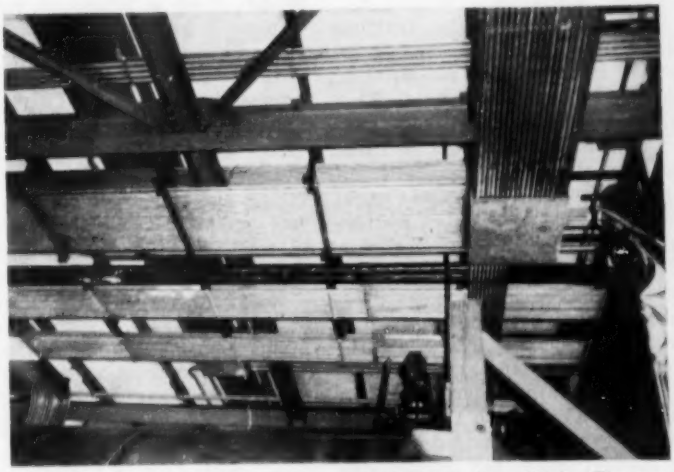
Different wire sizes were kept to a minimum, so far as the overall economy dictated. Single conductors, with RH or TW insulation, were the general rule in conduit except that the 2400-volt wiring in conduit tended toward 3-conductor cable. Color coding of phase and control wires was completely standardized.

Busduct was used only in connecting the substations to the control centers. Sizes 1 and 2 starters were protected by time delay fuses, sizes 3 and 4 by circuit breakers.

The electrical engineer used a unique keying system in his layout. Each substation was given a number, usually some multiple of a hundred. Control centers were indexed to the related substation numbers. Motor circuits were given subdivisions of the control center number. Letters were used to indicate the general type of equipment or construction. The related drawings in the final subdivision were numbered consecutively, to permit rapid assembly of a "set." As a specific example, drawings



CONDUIT PATTERN above covered control center. Note alignment of diagonals of junction box covers and how runs are racked for clearance.



SECTIONS of typical conduit runs to a height of about 30 ft. The geometrical pattern of the runs, part behind girders and part in front, makes for easy access and tracing of circuits.

CONVEYOR LIGHTING is provided by fixtures mounted on risers from the conveyor belt frame because the corrugated hood over the belt has no structural stiffeners to which units might be attached.

LIGHTING over conveyor belt comes from dust tight fixtures mounted on swivel mountings.

TWO UNIT SUBSTATIONS located just outside the wall; a 300 kva sub at left, a 750 kva at right.

78C1 to 78C6 referred to an alarm control system from control center 7800 which was common to substations 700 and 800.

While it added to the drafting load, each drawing was made complete in itself without reference to other drawings for details. This required some repetition of standard diagrams and tables of fuses and wire sizes, but the electrical engineer felt that the tracing problem was less than that of rectifying errors caused by a workman referring to the wrong detail drawing.

Standard diagrams were devised for the various motor and control circuits. Physical arrangements were shown rather than schematic diagrams. Connection numbers in the starters were carried back to the connections in the control stations and colors were indicated, without abbreviation, at each connection. Mr. Dansie noticed that the workmen were cutting the control diagrams out of the prints and pasting them in private scrapbooks.

How far Underground is Ground?

The topsoil of the entire site was capable of supporting plant life, if water came from somewhere else. Underneath this layer of soft dirt is a deep strata of volcanic rock which provides an effective seal over the water-bearing ground. As a result, no satisfactory results could be obtained from driven grounds or buried plates.

Rotary drilling equipment was used to sink 3-in. diameter grounding holes to a depth of 120 ft. Altogether, about 25 holes were drilled, being located at each transformer, substation, and lightning arrester group.

The holes were cased in the soft topsoil, with a fitting at the top to allow drawing the casing at any time desired. A No. 4/0 cable, with a weight on the end, was dropped to the bottom of each bore, and salt poured down the hole. That the cable was mechanically bonded to the casing at the pulling fitting and was reasonably in contact on down, was felt sufficient to relieve apprehension regarding any inductive effects in the casing.

If the substations were close together, the holes were cross-tied to provide a common ground for the area. Some cross-connection between grounding holes along the overhead lines was effected through the static wire.

Dual Power Control

Power is obtained from the two existing 700-kw steam-turbine generators and a 3750-kva substation supplied from the 14.4-kv system of the Continental Divide Co-operative of the Rural Electrification Authority.

An existing 2.4-kv switchboard was practically trebled in size, and now consists of 14 panels which control and meter the incoming circuit from the REA substation, the two generators, nine outgoing overhead lines, and two inside feeders. The main oil circuit breaker on the incoming line is rated at 1200 amps. The remaining 11 (two are each common to two feeders or lines) are rated at 600 amps.

One of the inside feeders supplies the existing 1000 kva substation. The other is for four compressors totaling 750 hp.

A 7-panel switchboard, installed as a comparison to the original 2.4-kv switchboard, controls the secondary distribution from the 1000-kva substation. Only slight alterations were necessary, and the existing load was close by.

The existing equipment more or less fixed the choice of voltages for the expansion. Primary distribution is at 2.4 kv. With two exceptions, motors of more than 100 hp are wound for 2.4 kv. Otherwise, integral horsepower motors are rated mostly at 480 volts. Lighting in the lesser areas is 120/240 volts, single phase.

The two original substations were composed of three 333-kva units and three 167-kva units, connected delta-delta. The new substations all have 3-phase transformers, connected delta-wye.

Caution Entered Design of Overhead Circuits

The distribution system was planned for general reliability and future expansion.

With a few exceptions, the 2.4-kv overhead circuits, in the plant area, are of No. 4/0 bare copper. Aluminum conductors, with weatherproof insulation, were used on both primary and secondary in the townsite. House drops are 3-wire, aluminum with steel neutral, terminating at roof masts.

Pole lines were designed for two circuits to a crossarm. Stain-balancing steel messengers were strung between crossarms having only one circuit. The 10-ft, heavy duty crossarms were drilled in the field. In order to keep line reactance to a minimum, phase wires were spaced on 18-in. centers. Climbing space, therefore, was in

the order of 3 ft. Vertical spacing between crossarms was standardized at 4 ft. To reduce swinging of the closely spaced conductors, and because of the heavy loading, span lengths were held between 80 ft and 105 ft.

The line from the REA substation to the main switchboard consists of three circuits in parallel. Take-off from the substation ran all nine wires, in horizontal configuration, to a modified H-frame. The phase conductors were strung on 8-in. centers, with the phases spaced at 36 in. Risers from two sets were phased out on a horizontal bus, strung two wires to a phase, near the top of the structure. The bus was connected to two conventional circuits occupying positions on the top and bottom crossarms of the pole line. The third circuit was run directly from the takeoff, up the structure, to the opposite end of the top crossarm. At the switchroom, each circuit was connected to a 3-c, 500 MCM cable in 4-in. conduit for the run to the main circuit breaker.

All overhead lines but one terminate on strain insulators at the main distribution frame. This structure is of steel, 26 ft high and about 18 ft wide, raised on one end of the switchroom roof, and anchored to the walls of adjoining buildings. Conduits from the main switchgear were hung from the switchroom ceiling on hangers and run up the frame to weatherheads near the outside lines. Conduit and cable sizes were the same in all runs.

To avoid long circuits or obstructions, as well as for safety reasons, the overhead primaries went underground at three places. The most elaborate was a little over a 100-ft stretch under an extension being made to a building. Eight 4-in. fiber conduits were placed under grade in a concrete sheath. Two were capped for futures. Four active and two spare circuits were of 3-c, 500 MCM cable. Another underground, of similar construction, was placed near an existing circuit under the airplane runway. A 3½-in. and a 2-in. conduit were placed as spares. The third, a 3-circuit installation consisting of two No. 4/0 cables in 3-in. conduit and 1,500 MCM cable in 4-in. conduit, was laid under a conveyor. Also, overhead connections were avoided at the substations, even if only to run the primary in conduit down a pole. Most substation primaries, however, actually did run underground below roads or otherwise.

The plant is located in a severe thunderstorm region, so extra precautions were taken against lightning disturbances. A continuous static wire, grounded at the transformers, was strong on pole-top bayonets. When the lines went underground, the static wire was laid in the concrete sheaths with, but not in, the conduits. Lightning arresters were connected to each primary phase wire at the transformers, and at each transition from overhead to underground.

Fig. 1 indicates how the primary lines were carried along with spare circuits and how heavily the poles are loaded. In one place, the weight of the wire alone is about 1000 lb. to a span.

Control Centers are Complete Systems

The general plan was to have a complete secondary control switchboard located near each substation. Also, for better operating control, motor circuits to natural groups of processing stages were not divided between control centers.

A manual transfer switch, however, permits one power control center to be served from the main center at either of substations 700 or 800. An automatic transfer switch with a manual preference selector permits a similar shifting of the lighting load in the same area. Another automatic transfer will shift a complete section between the main centers at substations 300A and 300B.

The main control centers each were assembled from standard units to suit the particular area or load. The main assemblies contain a bus, a built-in lighting substation, a main lighting breaker, and a 24-circuit lighting distribution panel.

The lighting substations are 480-120/208 volts, 3-phase, wye. Units rated at 15 kva are 3-phase transformers. Those rated at 30 kva consist of three single-phase units.

The individual motor circuits are controlled by draw-out units, and are interchangeable. Each motor cubicle contains either a circuit breaker or set of time delay fuses, the starter, a 480-120-volt control transformer, red and green lights, and a stop button.

Fig. 2 represents the usual run of standard control centers. In

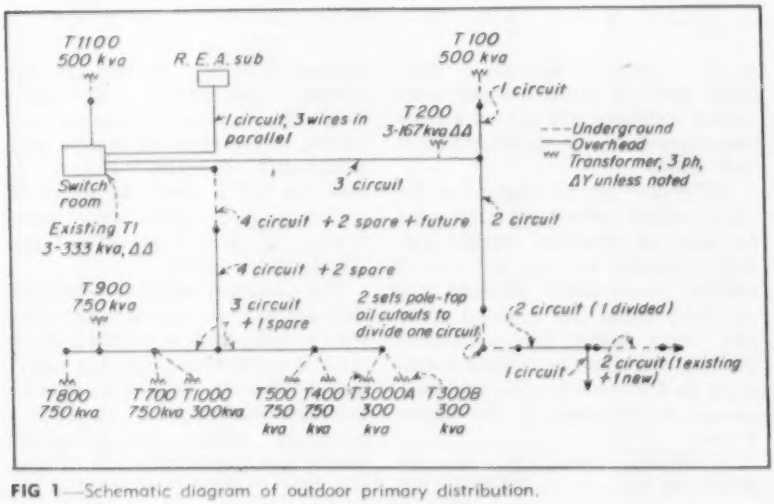


FIG 1—Schematic diagram of outdoor primary distribution.

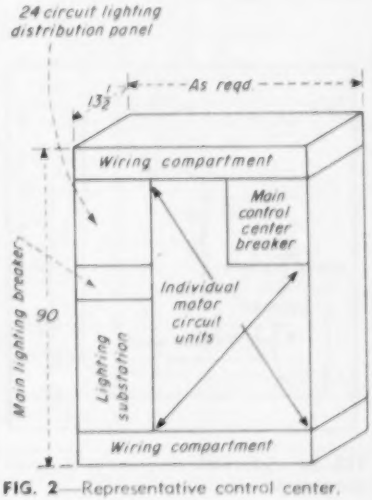


FIG. 2—Representative control center.

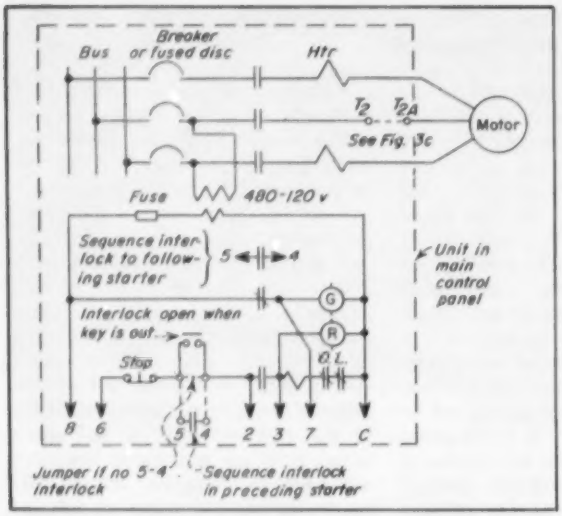


FIG. 3a—Standard starter connections at main control panel.

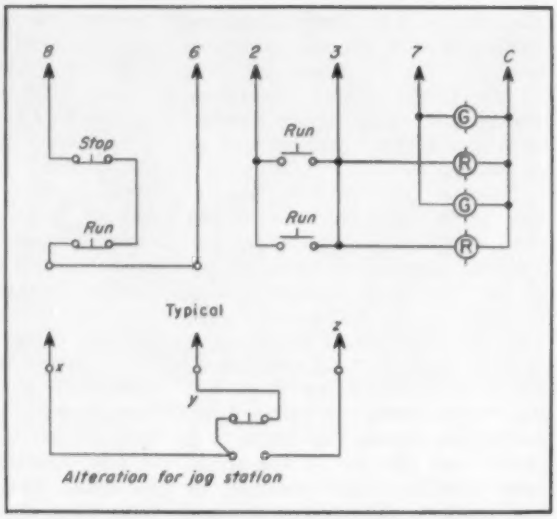


FIG. 3b—Schematic diagram of standard 2-station motor control.

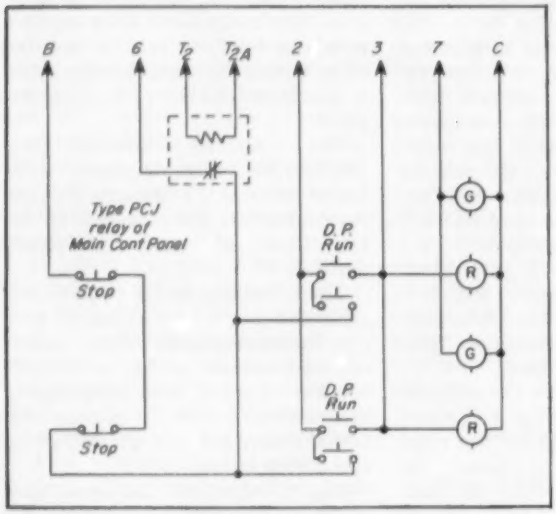


FIG. 3c—Schematic diagram of standard 2-station control using overload relay.

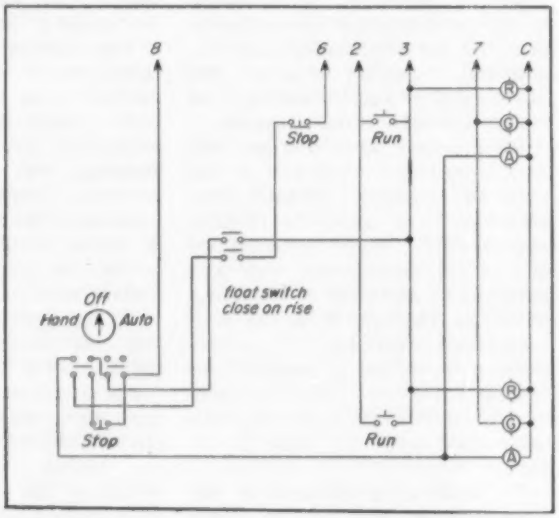


FIG. 3d—Schematic diagram of standard 2-station control with low-level-limit float-switch.

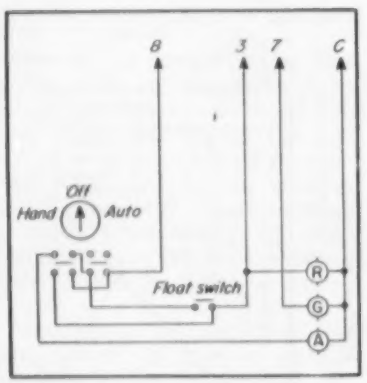


FIG. 3e—Schematic diagram of standard sump pump control.

some instances, adjoining units were used to house heavier main circuit breakers and caused a little departure from the standard height and depth.

All motors can be stopped at the main control center. Starting must be done at standard control stations near the motors. All remote control pushbutton stations are oil tight units. As a usual practice, bare wires for equipment grounds were run in the same conduits as the circuit wires and connected to the star of the transformer.

Mechanical handling, at the plant, has been developed to a high degree—the car shaker on the trestle, conveyors, automatic weighing, automatic sampling, agitators, float-controlled pumps, and electrically operated valves, to mention but a few. An error in sequence, or direction, could cause a waste of many thousands of dollars in short order.

The electrical engineer remarked that the system had been made as nearly fool-proof as possible. Each critical processing stage has interlocked controls, sometimes involving more than one area, to prevent operation unless the preceding stages are functioning. Interlocks also may be used to prevent start-

ing of one unit if the succeeding stage is not ready to go.

Fig. 3a is a diagram of the standard connections in a motor cubicle on the main control center. Standard symbols on the area wiring diagram indicated when to complete the interlock circuits. Insertion of relay at connections T_1 and T_{2A} was made only in instances explained later. It will be noticed that the operators have a complete visual indication on all power circuits leaving the center. (For simplicity, here, the different units of the control circuits were diagrammed separately. As mentioned before, the electrical engineer drew complete diagrams with each variation in connections.)

Fig. 3b represents the connections for a standard 2-station control within sight of the motor. The diagram should be used in connection with Fig. 3a.

Fig. 3c is a special variation of the standard 2-station diagram. In this instance, the operating coil of an overload relay is inserted in the power circuit to the motor. The 2-pole start button overrides the trip circuit of the relay, and must be kept depressed until the motor has reached normal speed. The relay, naturally, is more sensitive to increased motor loading than is the regular running protection of the circuit. Shutdown will occur if operating conditions cause a small increase in normal loading.

Fig. 3d is another application of the standard 2-station diagram. None of the controls will operate unless the float switch is closed. If the pump is on automatic control, all stop buttons (even at the control center) are ineffective. The standard plant system calls for the amber light to burn all the time a motor is set on automatic control. Normal operation of pumps in this particular process is automatic. Liquid must not be drawn down far enough to cause an air lock in the piping. Overflow is not a problem.

Fig. 3e is a simplification of Fig. 3d as applied to a sump pump. The only manual control is by means of the selector switch, or by opening the circuit protective device at the main control center.

An Alarm System Has Cascaded Controls

A unique combination of audible and visual alarms warns of high liquid level in a battery of tanks. A horn gives indication for a group of tanks, and a flashing red light points out an individual tank.

Since a sufficient number of relays were already on hand, the chosen arrangement was deemed to be more economical than some other alternates considered. For each tank, the alarm and control consisted of a pair of probes, relays and the light. For a group of tanks, there were installed a horn, a double pole switch, and a relay. A flasher was common to the entire system.

Fig. 4 is a skeleton diagram from one tank to the flasher. The liquid completes the 24-volt circuit from the first relay, which causes the operation of the second relay. One contact in the second relay turns on the red light. The other energizes the horn and a relay. This starts the flasher which causes blinking of any and all red lights which may have been connected at the time.

Fundamentally, all the equipment operates at 120 volts. The 24-volt circuit comes from a transformer inside the relay. When the low-voltage circuit is closed, the

(*Continued on page 279*)

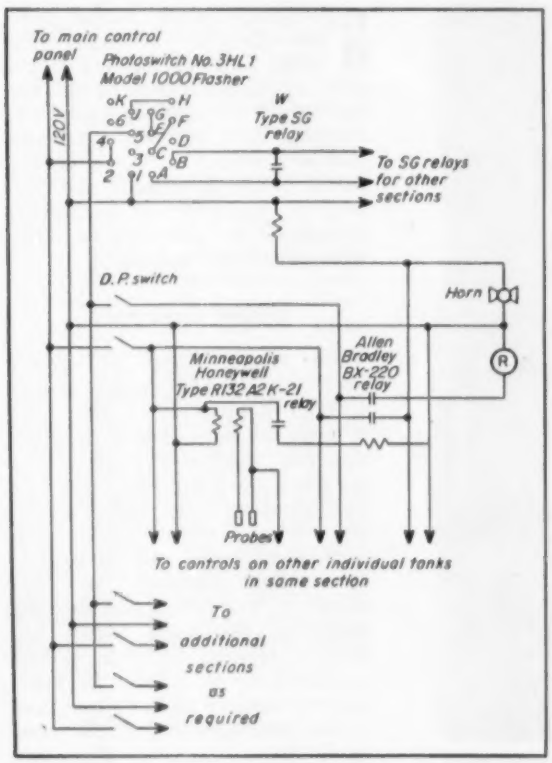


FIG. 4—Schematic diagram of controls on liquid-level visual and audible alarms. (All relay contacts not shown.)

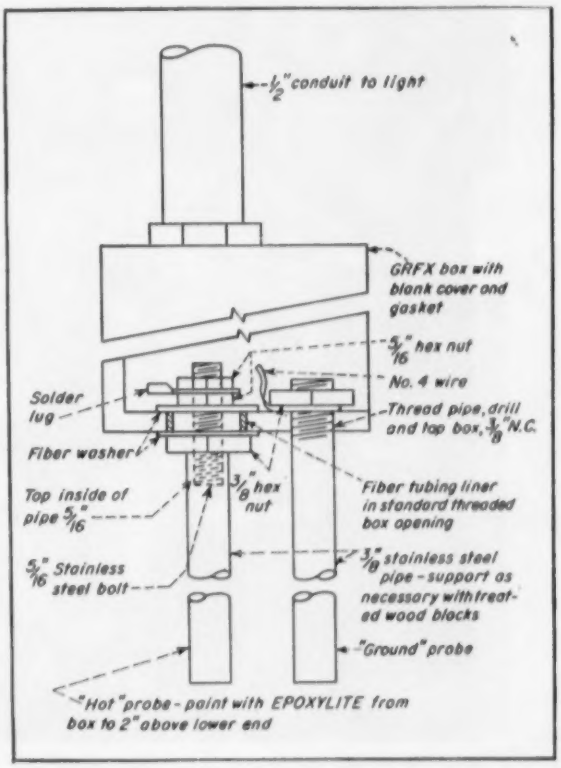
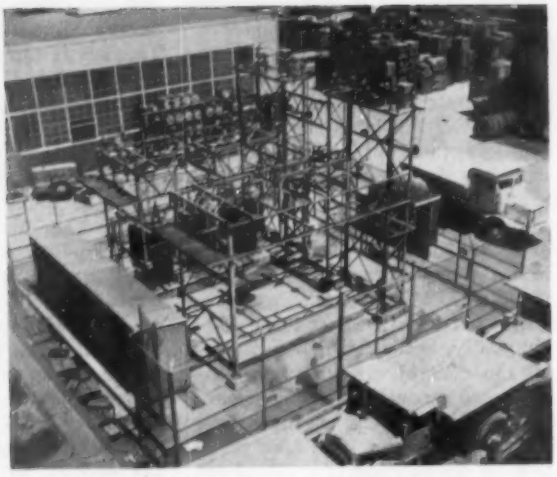

½" conduit to light
GRFX box with blank cover and gasket
5/16" hex nut
No. 4 wire
Thread pipe, drill and tap box, ⅜" N.C.
Solder lug
Fiber washer
Top inside of pipe 5/16"
⅜" hex nut
Fiber tubing liner in standard threaded box opening
5/16" Stainless steel bolt
⅜" stainless steel pipe - support as necessary with treated wood blocks
"Ground" probe
"Hot" probe - paint with EPOXYLITE from box to 2" above lower end

FIG. 5—Liquid-level probe assembly, not to scale.

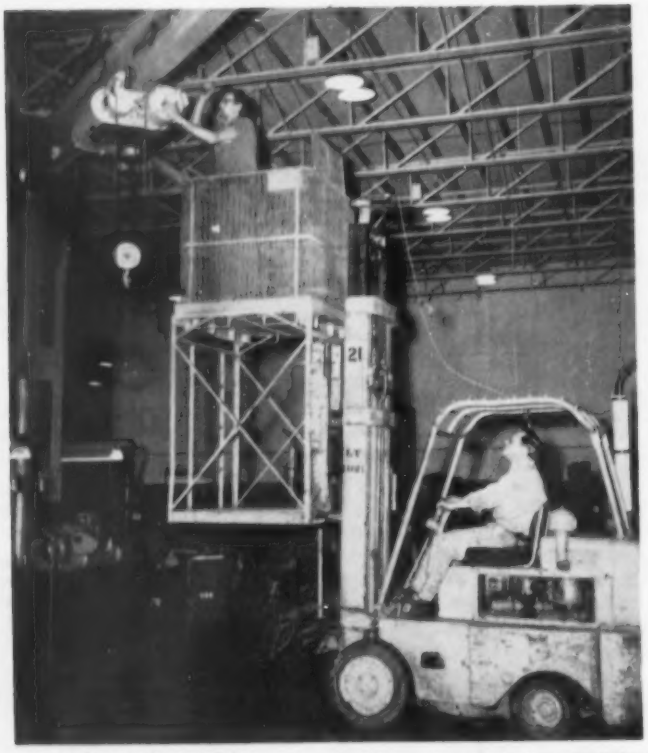
TEST-PROVED MAINTENANCE

for heavy-duty manufacturing



MAIN OUTDOOR SUBSTATION receives 33-kv primary current through underground utility feeders, transforms it to 4600-volt for underground distribution into plant.

Manufacture of heavy-duty earth-moving equipment is an oversized production assignment. Power consumption is impressive; control is mandatory; distribution must be positive. Emphasis, therefore, is upon continuous operation and upon a take-nothing-for-granted maintenance department backed by test-proved methods and techniques.

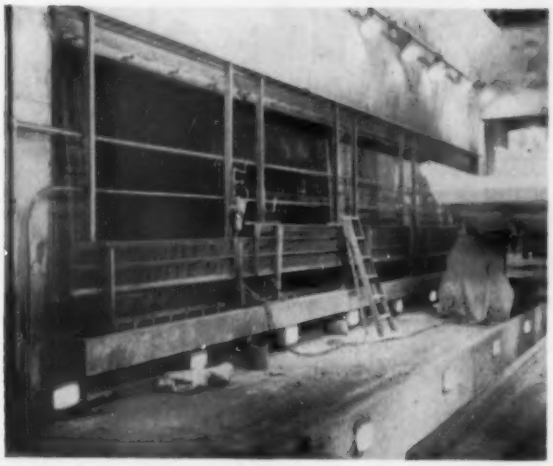


MAINTENANCE PLATFORM, raised and moved around plant by fork-lift truck, is equipped with ladder, tools and equipment trays to facilitate medium-level repairs and inspections.

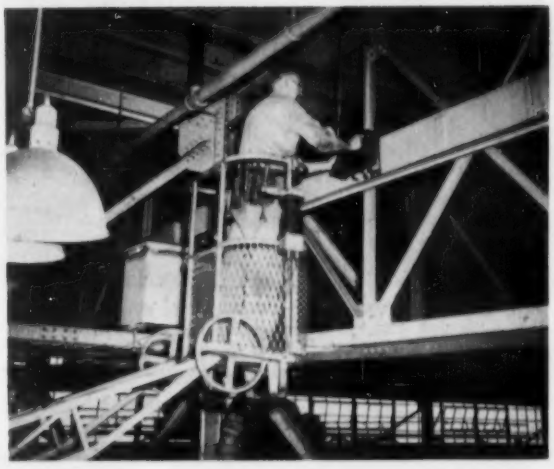
GENERAL Motors' Euclid Division plant in Cleveland, Ohio totals 5½ acres under a single roof, and its power demand calls for the output of eight 650-kva substations. Also, due to the extreme size and weight of some of the parts being machined and assembled, much of the production equipment is considerably oversized by normal standards.

Rugged Equipment

For example: one of several electrically-operated press brakes develops a pressure of 2200 tons to form 90-degree bends in 30-ft-long ¾-in. thick steel plate. There are also a shear for 1-in. plate, two track-mounted 8-ft radial drills, two cold saws, two automatic torch cutting machines and 75 electric arc welding machines for body-assembly. For lifting and shifting materials, the plant boasts 110 electric cranes: 67 jibs having capacities up to 2 tons, 32 semi-gantrys ranging up to 7½ tons, and 11 overhead travelling cranes rated up to 25 tons capacity. There are also numerous special hooks, grapples and other devices used to



ENCLOSED PAINT SHOP is equipped with downdraft water walls, updraft air system for central pits, explosion-proof lighting units and motor-operated doors between sections.



WORK CAGE at end of Skyhook boom, controlled by maintenance worker carried therein, can be raised or extended in any direction for distance of 40 ft from its mobile base.

handle plate and bar stock, while 16 motorized fork-lift trucks provide additional facilities for shifting materials stored in containers or on pallets.

Final inspection of products is performed at a test stand, having a 10,000-cfm air exhaust system to keep the atmosphere free from exhaust fumes, while final assembly of the many earth-moving equipments is completed as an endless-chain pulls units along a 220-ft line at a steady 6-fpm pace.

After assembly, vehicles are cleaned, spray-painted and touched up in a 180-ft-long drive-through 3-section booth; each section equipped with a separate high-capacity (up to 96,000 cfm) downdraft air exhaust system, water-curtain walls to collect paint spray and fumes, explosion-proof lighting and electrically-operated doors. Central 6-ft-deep pits in these booths are also provided with separate up-draft forced-air systems to prevent paint from settling on men spraying the underside of vehicles.

Lighting units on both sides of each booth are 500-watt incandescents, mounted on 5-ft centers at three elevations: floor level, 20 ft above the floor, and recessed into pit walls. Upper units are inclined downwards 45 degrees to concentrate light on vehicles being painted, while floor and pit lights are protected by wire guards.

33-kv Primary Power

Primary power for this plant is received at an outdoor pad-

JEEPS, equipped with ladder racks, tool and stock bins, are used throughout the plant. Also used extensively are bicycles equipped with carrying racks, lift trucks and mobile work benches.

MAINTENANCE CENTER has practical work bench constructed around vertical pivot post of 2-ton gantry crane. Local fluorescent lighting, power outlets, lathe and grinder are provided for convenience of electrical department.

SOLVENT TANK has gravity-closing metal cover, held open by fusible link that melts when subjected to sudden or exorbitant temperature rise. Fusible element likewise controls operation of C02 system having vents positioned inside of tank just above solvent level.

LIGHTING TOWERS in exterior 10-acre storage area support up to 24 floodlights each; are electrically served by 4600-volt underground feeders; have individual transformers, twist-lock 115/230-volt power outlets and walk-in 2-way communication booths.

mounted fence-enclosed substation (via underground utility feeders), where three oil-filled air-cooled transformers step 33-kv current to the plant-distribution level of 4600 volts. Power is carried at this level into the plant's main pull box (again via underground ducts), then upwards to roof-truss elevation where feeders in conduit radiate to the eight previously-mentioned overhead substations.

Each sub combines a 500-kva power transformer (stepping current to 220 volts) and a 150-kva unit for lighting purposes (at 115/230-volt), with substations grouped together in twos so that four transformers are available to handle all power and lighting requirements in each two of the plant's eight 70-ft-wide 400-460-ft-long bays.

From these substations, current for power is carried through manufacturing areas via busducts (separate runs for normal uses and for automatic electric-welding equipment), while circuiting for lighting is continued via cable in conduit.

Mercury-Incandescent Lighting

Lighting inside the plant is furnished by a combination of 400-watt mercury-vapor and 1000-watt incandescent lamps in standard twin RLM reflectors; these 2-lamp assemblies mounted in a 16-by-20-ft pattern at an elevation of 33 ft to provide average illumination intensities of 35-footcandles on working planes.

For outdoor illumination, 132 tower-mounted floodlights are mounted atop six 65-ft poles located in the storage area (grouped as 24- or 18-light units), while numerous additional floodlights are positioned along parapets of the main building. All reflectors are polished aluminum while (depending upon purpose and effective throw of lights) glass cover panels are either clear or stippled.

All tower lights are controlled from a pushbutton station located in the plant's main gatehouse; six lights on each tower remaining on all night for basic protective purposes, while the remainder are turned off at the completion of the second work-shift. Current is delivered at 4600-volts to the base of each tower, where it is stepped to utilization level by separate 3-phase wye-connected transformers.

Stacks of metal parts being stored in this outside area frequently extend to heights of 14 ft, yet, due to the high mounting and careful aiming of floodlights, the light distribution is fairly even and shadows are at a minimum, thereby providing adequate illumination for both working and protective purposes.

While on the subject of these lighting towers and transformer stations, it is of added interest to note that each such station is provided with a weatherproof power receptacle so that 115/230-volt current may be readily available throughout the storage yard when so desired for use of power tools or other equipment. Each station also has an open walk-in sound-suppression booth containing 2-way communication equipment that links yard personnel with inside operating and maintenance centers. Blanket paging of outside men is by means of multiple weatherproof trumpet speakers (mounted on tower masts 20 ft above ground) that may be distinctly heard in all sections of this storage area.

This outside equipment augments the plant's overall communications system which, in addition to interior PA speakers for paging and announcements, includes numerous talk-back stations, audible and illuminated signals, plus intra-plant dial phones.

Inventory Records and Storage

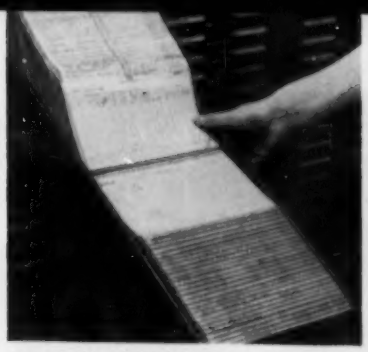
Maintenance of motorized production equipment, cranes and welding units, distribution and control components plus all lighting, is performed by a basic 9-man crew assisted, when necessary, by additional specialists and contracted labor. Scheduling and direction of maintenance work is from a centrally-situated office, storage and repair center, where constant attention is focussed upon accuracy, speed and efficiency.

In the interests of those objectives, considerable thought has been devoted to the arrangement and maintenance of inventory stock, motor records, regularly scheduled

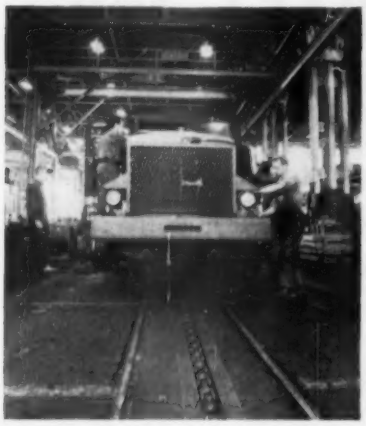
AUTOMATIC electric welders speed fabrication of truck bodies, provide high-quality workmanship and insure uniformity of finished products.

FLOODLIGHTS have polished aluminum reflectors and either clear or stippled glass covers, depending upon purpose of light, type of beam and distance of throw. Six lamps in each bank remain on all night to provide basic security.

KARDEX file is kept constantly up to date in order to accurately identify and locate over 8000 electrical replacement items that are kept in stock for maintenance purposes.



PERPETUAL INVENTORY cards, kept on each item, list parts by name, catalog number, description and purpose, their progressive purchases, withdrawals and residual levels and the distributor.



MOTORIZED endless chain pulls hefty 50-ton 600-hp earth-moving truck along final 220 ft of assembly line in Euclid's mammoth manufacturing plant in Cleveland.

30-FOOT LONG press brake, developing 2200-ton working pressure to form 90-degree fold in ¾-in. steel plate, symbolizes magnitude of oversized production equipment used in this plant.

COMBINATION mercury - incandescent lighting for factory areas is provided by standard RLM polished-aluminum twin-reflector units mounted at truss elevation. Maintained illumination is 35 ft-c.

plus emergency work histories, electrical test data, wiring diagrams and blueprints. Any changes in these records are entered promptly, thereby keeping reference files constantly up-to-the-minute. A complete file of maintenance check-lists and routines is also kept in book form so that electricians may study or refresh their memories when they are called upon to analyze some of the less-frequently-encountered plant maintenance problems.

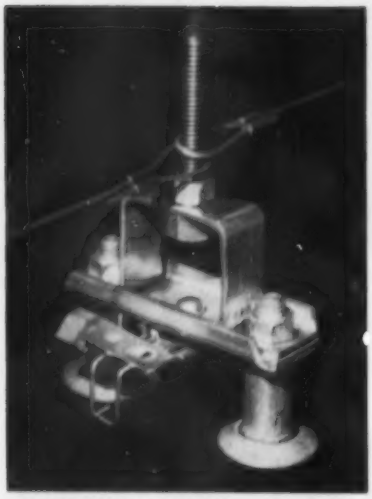
Since over 8000 electrical replacement items are carried in stock, a separate Kardex index is kept to quickly identify and describe these parts, indicate storage-rack or bin numbers, and to record bin locations. This index is in addition to a perpetual inventory which records parts, their respective catalog numbers, progressive purchases and withdrawals, residual amounts in stock, preferred brand names, and distributors' phone numbers, discount schedules, warrantees and delivery procedures.

In addition to bins for small parts, numerous special racks have been constructed from bolted or welded pipe or angles to hold larger items. For example, ladders of all lengths are stored in vertical rack tiers on a welded-angle frame. Conduit is stored on welded A-frame racks, with supporting arms protruding from frames at 18-inch height-intervals. Large cable reels are stored on racks formed by bolting perforated angles together in a variety of arrangements, and small reels are stored on spindles extending from walls or secured to lower flanges of overhead beams. Special reel racks have also been constructed on pallets, so that reels may be lifted, moved around the plant as needed and raised for convenient elevated use by a fork-lift battery-operated truck. Since the summation of this equipment constitutes a considerable weight, much of it is stored on a metal-plate balcony which is serviced by a travelling crane and illuminated by mercury-vapor luminaires.

Maintenance Center

At this same maintenance center, equipment is available for testing and repairing all types of motors (except for rewinding), controllers, lift trucks and various electronic devices. For example, in the lift-truck area, a very practical steel work-bench has been constructed around the vertical pivot post of a 2-ton jib crane. This bench supports such equipment as a grinder, lathe and sparkplug cleaner; it is equipped with 115- and 230-volt single-phase polarized twist-lock 3-prong grounded plug receptacles; is locally lighted by arbor-mounted industrial 3-lamp

(*Continued on page* 194)



ROLLER-TYPE HANGER is the key to roll-in method. Wedge-shaped ball-bearing rollers ride V-slots in duct case. Wire guard in center holds tow cable, spreads open when duct hits lever to release cable and guide duct onto rollers. Looped cable above hanger is "spacer cable" between hangers.

Contractor-Designed

ROLL-IN SYSTEM FOR TROLLEY DUCT

. . . cuts circuit and fixture installation time by 50%. "Somes Method" uses roller-type hangers and a single-station work platform.

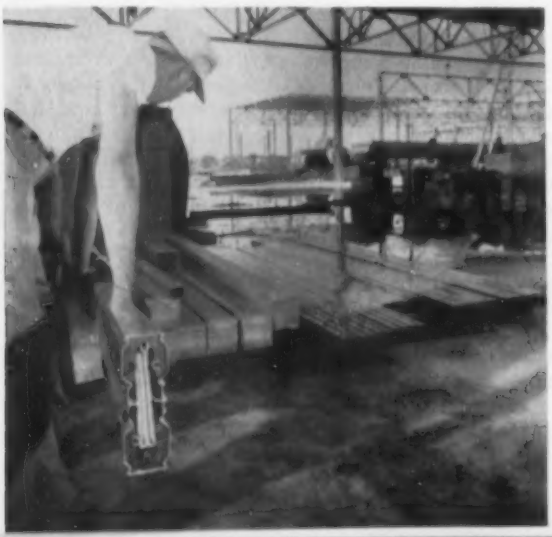
LIGHTING trolley duct and industrial fluorescent fixtures are being installed in less than half the time formerly required for this type of system. And electricians are doing it from a single-station work platform that requires only one position per line of duct.

Installation efficiencies of this order are the direct result of the "Somes Method", latest job-mechanization contribution of Fred Somes, Jr., head of Motor City Electric Co., Detroit, and his staff of engineers who are always seeking quicker methods of installing better electrical systems. The new technique is essentially a "roll-in" system developed after some two years of field study and experimentation by the electrical construction firm.

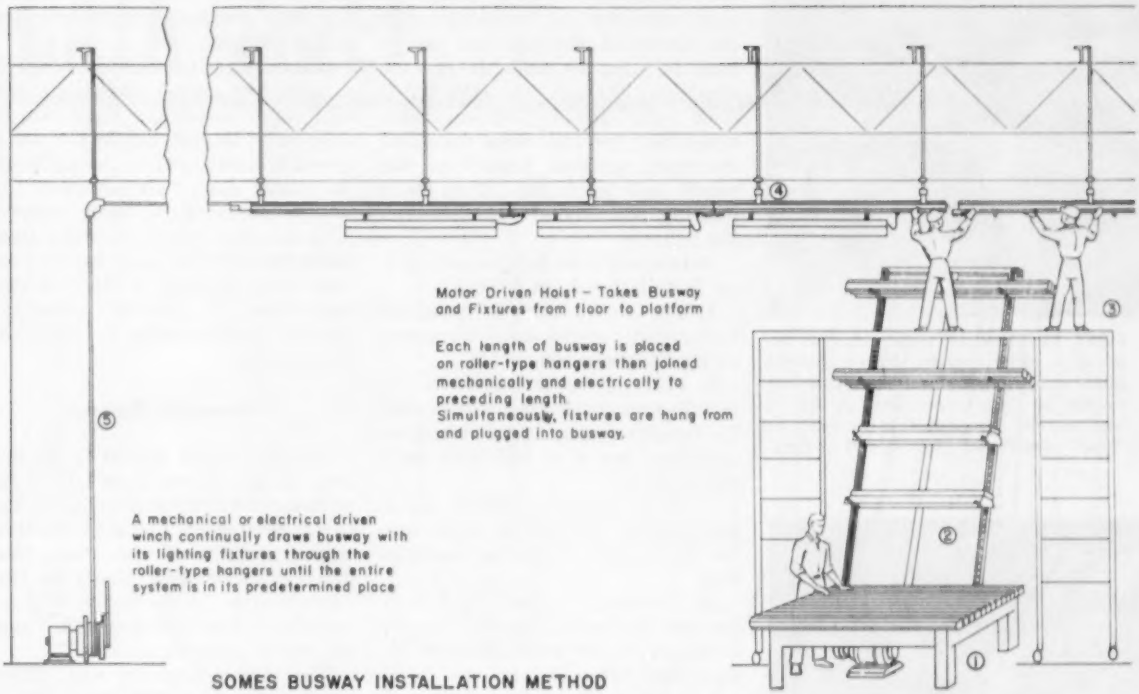
Basic component of the new method is an inverted-U, suspension type hanger with horizontal, wedge-shaped, ball-bearing rollers at the end of the two vertical fingers. The rollers were designed specifically for the General Electric Type LTG Busway since the contours of the steel duct enclosure provide a V-shaped slot on each side in which the hanger rollers can ride to provide the roll-in feature while supplying the major supporting means.

Although the roller-hangers are the key to the new technique, the experienced man-hour economies are dependent upon the overall installation technique employed on specific jobs. This involves such additional equipment as: rolling

DUCT SECTIONS are unpacked and stacked prior to transfer to the assembly table. Sections are 10-ft. long; have 2- and 3-poles; are rated at 50-amps.



PRE-ASSEMBLY of duct sections is done on rolling table in front of platform elevator. Here, mechanic tightens mechanical couplings after having inserted fixture hooks according to template pattern.


Motor Driven Hoist – Takes Busway and Fixtures from floor to platform
Each length of busway is placed on roller-type hangers then joined mechanically and electrically to preceding length. Simultaneously, fixtures are hung from and plugged into busway.
A mechanical or electrical driven winch continually draws busway with its lighting fixtures through the roller-type hangers until the entire system is in its predetermined place
④
③
⑤
②
①

SOMES BUSWAY INSTALLATION METHOD

SOMES METHOD of roll-in trolley duct installation is an integrated sequence operation incorporating (1) an assembly bench; (2) electric elevator; (3) one-position work platform; (4) roller-type hangers; and (5) winch and tow cable to pull in assembled line of duct complete with attached fixtures.

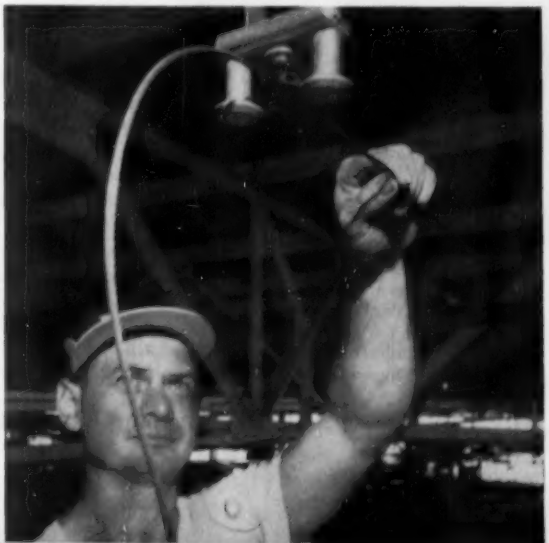
assembly tables; motor-driven elevator to raise duct and fixtures to the work platform; pre-assembly of fixture hangers and duct couplings; hand or motor-operated winch and tow cable to pull in the assembled duct sections complete with attached fixtures. As used on Motor City Electric jobs, the complete method approaches assembly-line, mass-production techniques; has allowed 4- and 5-man crews to install duct and fixtures at a 16-ft-per-minute clip.

The Somes Method is a closely integrated sequence of individual operations keyed to a continuous flow of pre-assembled components to a platform crew. Here final mechanical and electrical connections transform sectionalized units into long duct runs complete with fixtures. A winch and tow cable pulls the assembled trolley duct through the roller-hangers until the run is completed. All that remains is to install the home runs to the panel and energize the circuit.

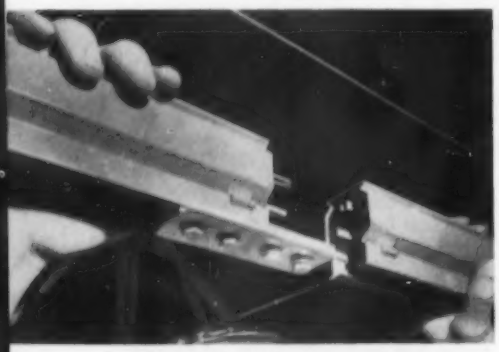
With the exception of hanger installation, all operations are centered around the work platform, which remains in one position during the installation of a complete duct run. It is then moved to the next line of duct for a repeat sequence. Normally, the platform is stationed at one end of the run. Experience proves that 500 ft to 600 ft of duct, with fixtures attached, can be pulled in with a hand winch. As longer runs increase the weight, power winches can be used.

ELECTRIC ELEVATOR raises duct sections and assembled fixtures in pre-arranged sequence to crew on top of work platform. Crew unloads elevator, assembles duct, hangs and connects fluorescent fixtures from this one position.

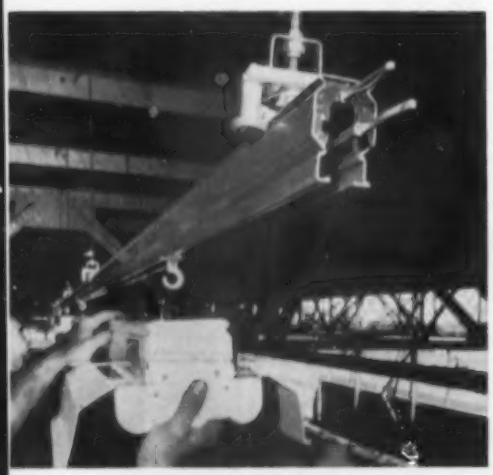
TOW CABLE is inserted in wire clip between hanger rollers. When clip is closed (open in photo) it supports cable. It opens to release cable when lead section of duct hits clip lever. U-bolt fastens spacer cable to hanger rod.



FIRST SECTION of trolley duct is inserted in roller hangers. Heavy channel coupling at right connects only first two lengths of duct to provide rigid 20-ft. lead section. Tow cable is fastened to "head" attachment at other end of duct.



COUPLING TWO duct sections on work platform. Electrical connection is provided by telescoping spring clip; mechanical connection by four-bolt steel coupling at bottom. Two bolts at right will be tightened when duct ends butt.



HANGING FIXTURES (8-ft. fluorescent units) to pre-assembled hooks on duct. Note how hanger rollers nest in duct slots. As sections and fixtures are progressively added, winch pulls assembled duct line through roller hangers.

On exceptionally long runs, the work platform can be positioned in the center of the run and assembled duct can be pulled-in in each direction. On one job with 200-ft duct runs, Motor City engineers noted that two men were installing the duct without benefit of the winch and tow cable. They were pushing the line of duct through the hangers.

Actual sequence followed on typical installation is as follows:

1. The trolley duct is unpacked and placed, continuous-slot upward, on a rolling assembly table.

2. Fixture supporting hooks are installed on duct sections according to template spacing. Mechanical couplings are also added to each duct section.

3. Fixtures are unpacked, lamps and plug-in connections added and the units made ready for installation.

4. Completed fixtures and duct sections are raised, in prearranged sequence, to the work platform by an electric lift.

5. Duct sections are connected electrically and mechanically at the work platform. Fixtures are mounted and connected.

6. As duct sections are progressively added, the duct line is pulled through the roller-hangers by the winch and tow cable.

7. When the duct run is completed, a dummy section of duct is removed and replaced by a connection box and the home run is installed to the distribution panel. When this is completed, the duct line with its fixtures is ready to be energized.

Normally, a 5-man crew is used. One man is stationed at the tow winch; one man at the elevator to load the pre-assembled duct sections and fixtures; three men on the work platform to unload the elevator, connect the duct and hang the 8-ft fixtures.

The hangers, of course, must be installed before the duct installation sequence is started. Actual mounting methods vary with the specific job. Where possible, Motor City engineers prefer to have the men install them "from topside" before a roof deck is added to the steel work. Here, mechanics work from a rolling cart (labeled "flying carpet" by the men) whose flanged wheels ride the steel purlins. This works well on large-area, flat deck construction. Where this is not possible, hanger units can be installed from the underside with men working on rolling scaffolds or ladders. Choice of method depends upon the job conditions.

Hangers are normally installed as a complete unit—suspension rod and roller assembly. They can, if necessary, be installed in two steps —rod first and roller assembly later. In either case, "spacer cable" is always fastened to each hanger. This is a galvanized, stranded steel cable connected at each rod to prevent sway parallel to the duct line and eliminate possible misalignment of hangers when the duct run is pulled in.

Advantages Gained

To date, some 80,000 ft of 50-amp, 2- and 3-pole Type LTG duct with 8,000 to 10,000 fluorescent fixtures have been installed in this manner. Most of the work was done in automotive plants in the Detroit area. More Somes Method installations are being specified and are on the drawing boards.

The roller hangers and other equipment used with this technique are available to anyone who installs the Type LTG, G. E. duct. Mr. Somes has applied for patent coverage of method and related equipment and General Electric Co. has obtained the right to supply the necessary equipment through its normal distribution channels.

Man-hour economies to the contractor employing this roll-in method are quite evident. In fact, on one large project, several electrical contractors figuring a pipe-and-wire lighting installation were asked to give an alternate bid on this technique, using the trolley duct. The alternates were lower than the original bids. In addition to lower cost, the owner would get the added flexibility of the duct system.

There are other advantages to both contractor and owner. The one-station work platform leaves the rest of the floor area free for installation of machinery or other activity. The amount of scaffolding a contractor must use is substantially reduced. The work load on the mechanics is much less.

The whole field of plant relighting is opened up by this technique. With the one-station work area, relighting can proceed without disrupting normal production. While no jobs of this type have as yet been installed, Mr. Somes is confident that such relighting can be done quicker without overtime.

Feeder Voltage Drop and Current Capacities for 600-Volt, Type RH Conductors

VOLTAGE DROP AND CAPACITIES

60 cycle—three-phase in steel conduit (49°C temp.)
Reference: Standard Hndbk. Elect. Engrs.

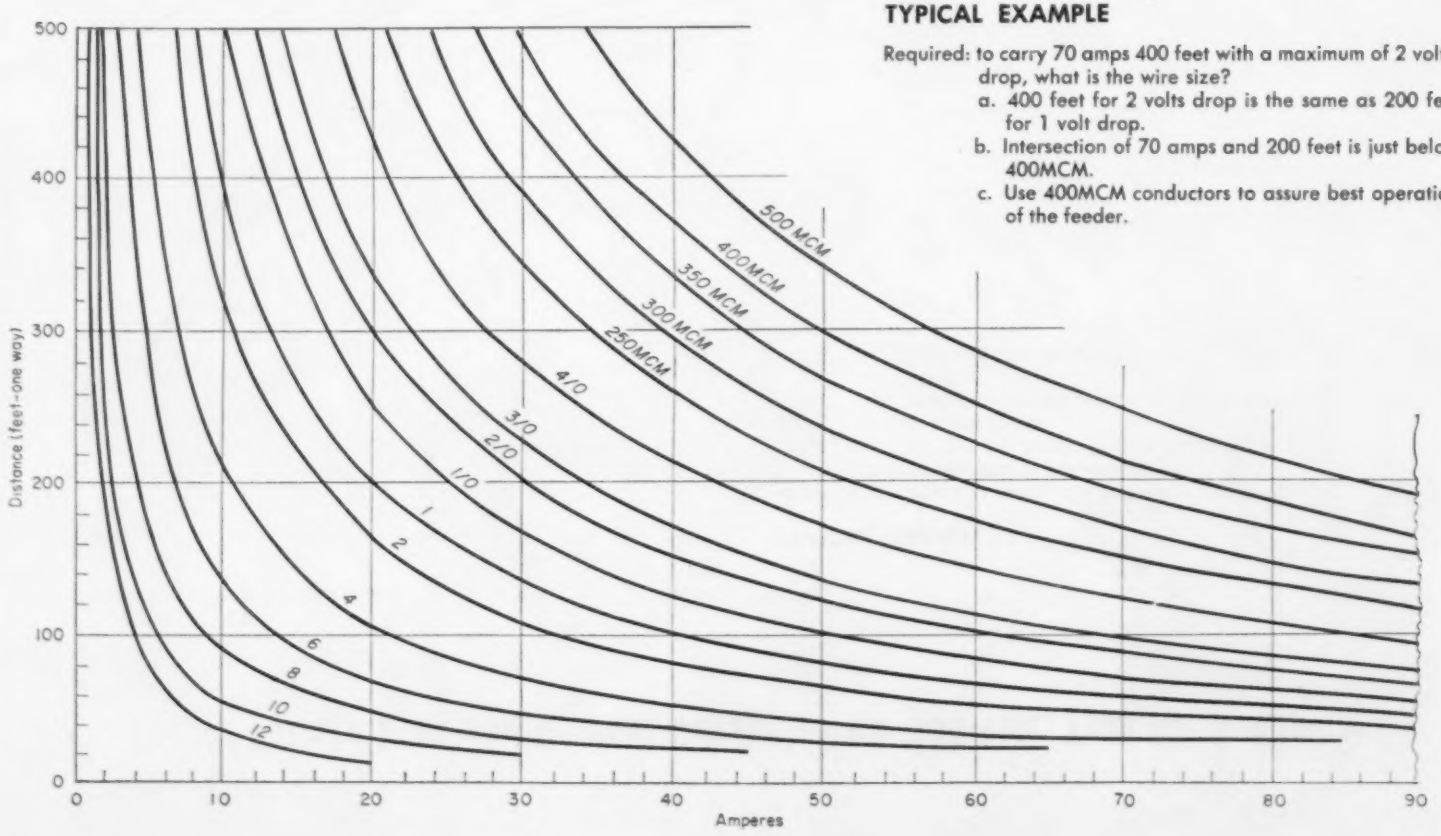
GENERAL NOTES

Curves are for a 1-volt drop and 90% P.F.
For any other voltage drop, ratio ordinates.
Capacities are for Type RH 600-volt insulation.

TYPICAL EXAMPLE

Required: to carry 70 amps 400 feet with a maximum of 2 volts drop, what is the wire size?

a. 400 feet for 2 volts drop is the same as 200 feet for 1 volt drop.
b. Intersection of 70 amps and 200 feet is just below 400MCM.
c. Use 400MCM conductors to assure best operation of the feeder.



Feeder Voltage Drop and Current Capacities for 600-Volt, Type RH Conductors

(Curves continued from previous page)

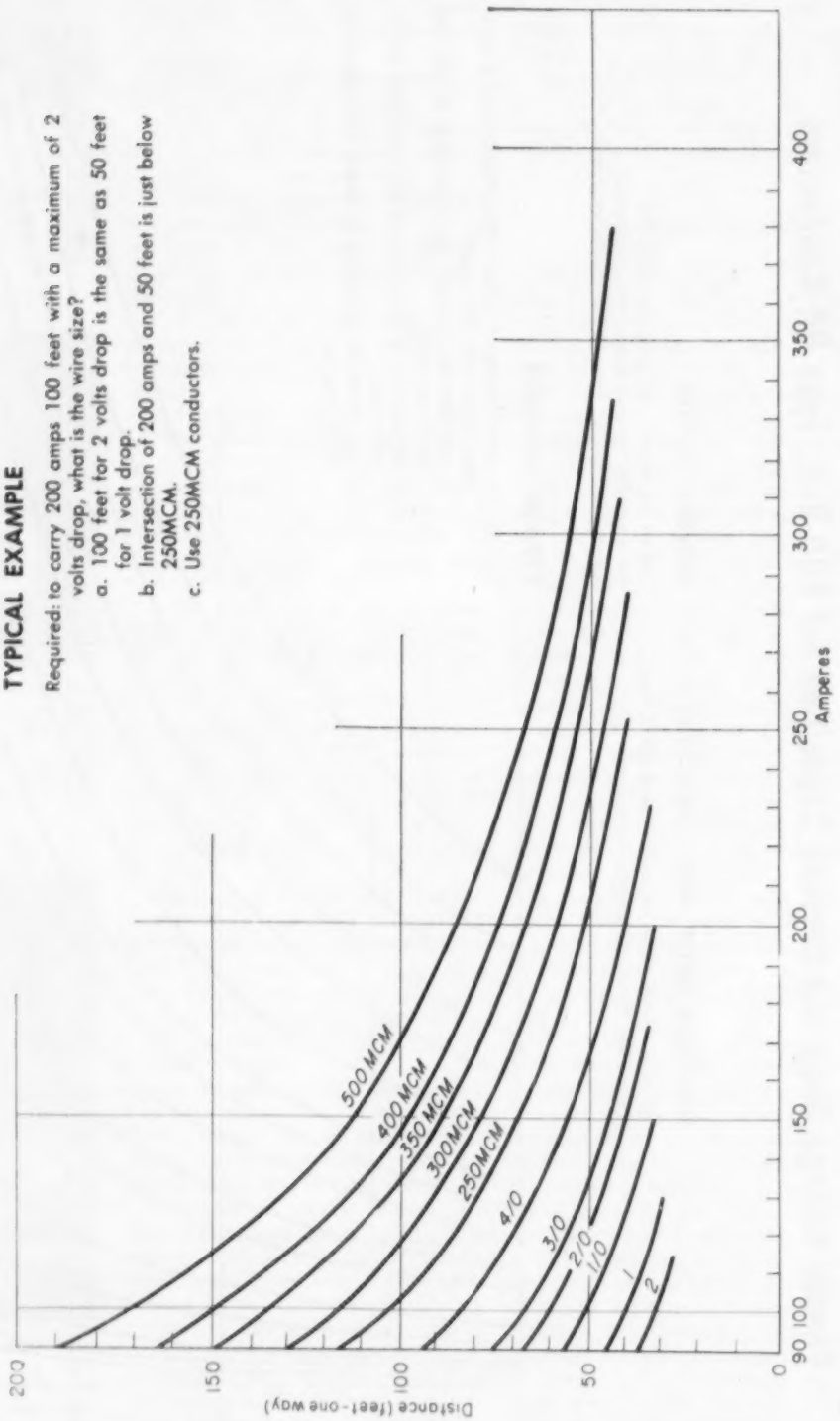
TYPICAL EXAMPLE

Required: to carry 200 amps 100 feet with a maximum of 2 volts drop, what is the wire size?

a. 100 feet for 2 volts drop is the same as 50 feet for 1 volt drop.

b. Intersection of 200 amps and 50 feet is just below 250MCM.

c. Use 250MCM conductors.



Submitted by Daniel M. Kabak, R. R. Popham Engineer, New York, N. Y.

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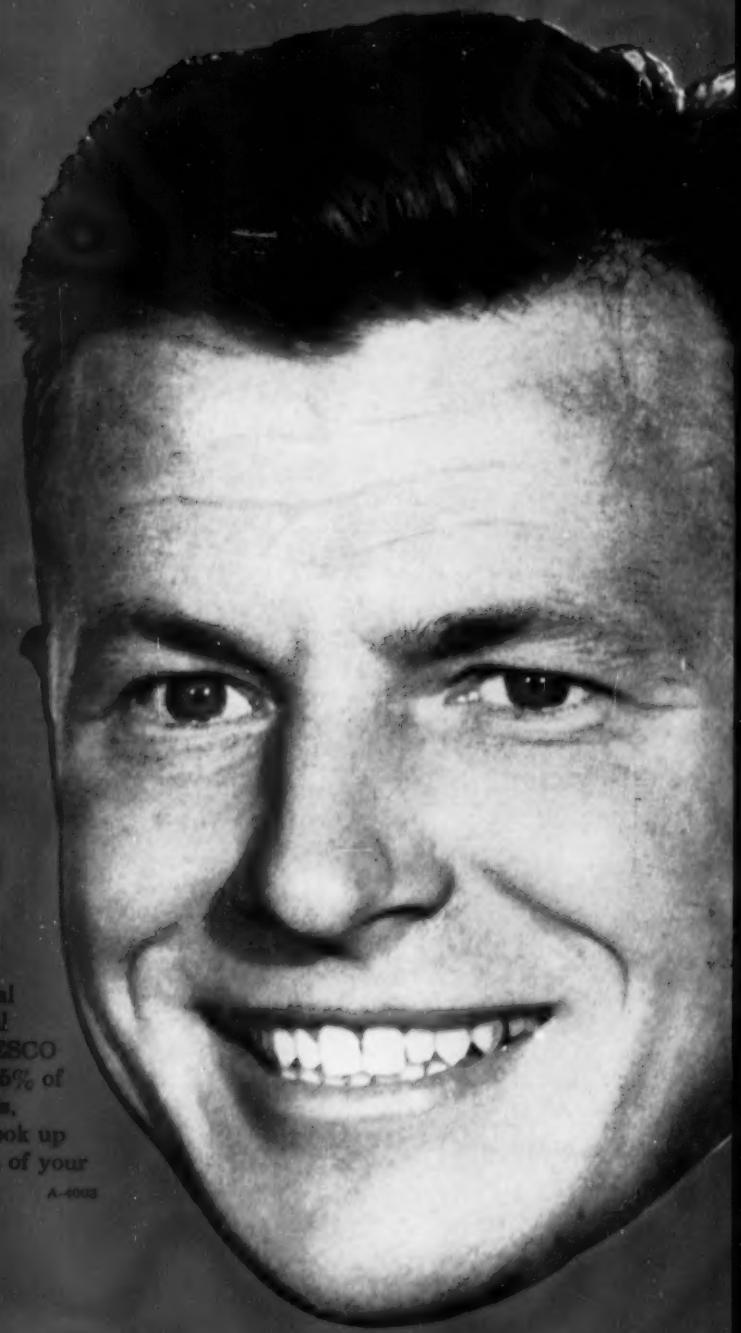

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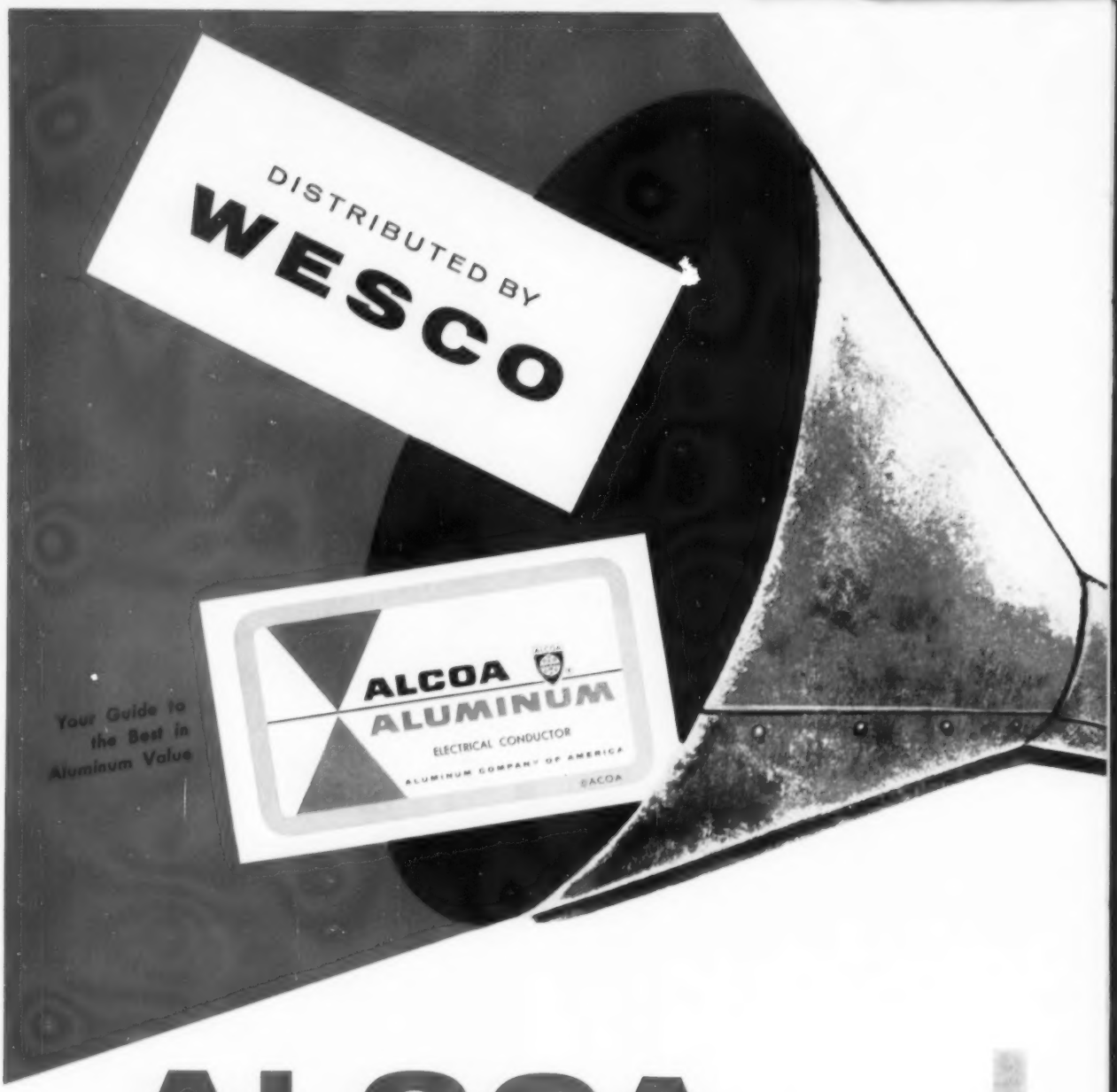

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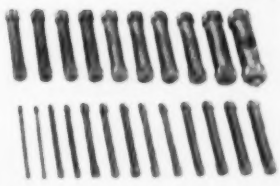

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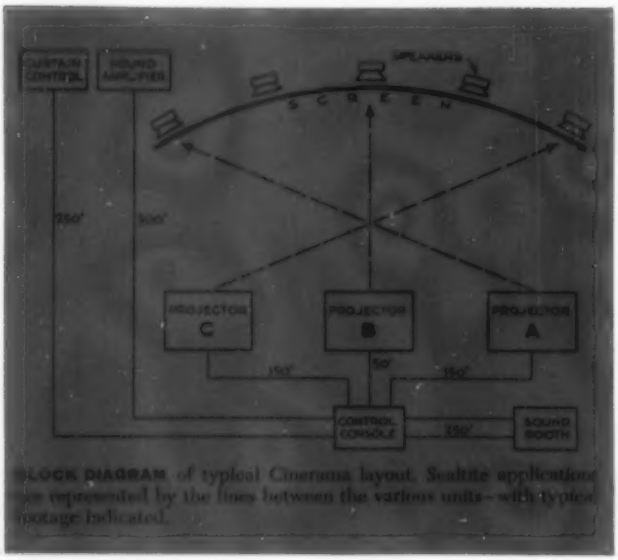


BLOCK DIAGRAM of typical Cinerama layout. Sealtite applications are represented by the lines between the various units—with typical footage indicated.

Backstage Cinerama is as fabulous as the 3-dimensional pictures out front. The units now being installed throughout America and around the world are actually pre-assembled . . . shipped ready-to-install, complete with thousands of feet of wiring protected by American Sealtite flexible, liquid-tight conduit.

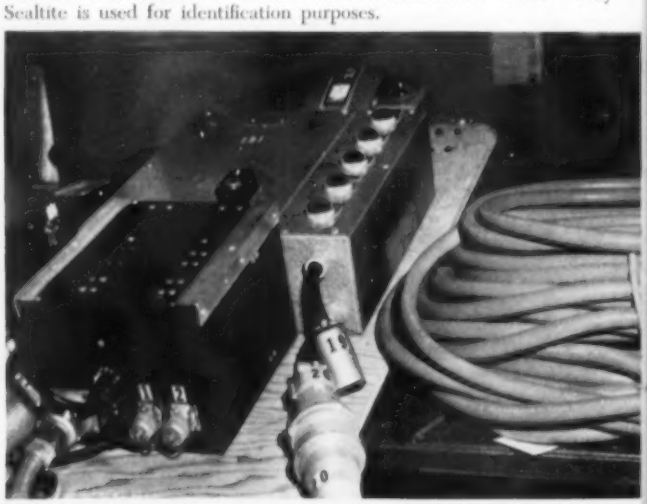
Each unit is designed for either outdoor or indoor use. Tough, moistureproof Sealtite protects sound, servo, intercommunication and curtain control cable from weather, shields against electrical interference, helps save installation time and guards cable from wear and tear.

Outlasts metal . . . costs less to install

In steel mills, salt plants, refineries and dozens of other industries, too, manufacturers are using this flexible conduit in long runs more and more often to replace rigid conduit.

STAGE SPEAKER RACK with sound input cable protected by Sealtite. Numbers on fittings identify various assemblies.

CURTAIN CONTROL and curtain intercommunication boxes. Gray Sealtite is used for identification purposes.



NEXT STEP: cable is pulled in American Metal Hose's ½" Sealtite flexible, liquid-tight conduit.

COMPLETED cable – with liquid-tight connectors attached to the Sealtite conduit.

against wiring failure

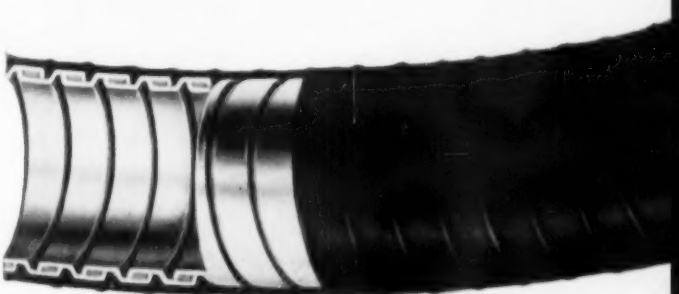
liquid-tight conduit

It's easier, less costly to install (especially in cramped spaces) and actually outlasts most metals in moist or corrosive atmospheres.

Where to get Sealtite

Electrical wholesalers stock Types U.A. and E.F.† Sealtite* flexible, liquid-tight conduit in easy-to-handle coils. Be certain you ask for, and get, the quality conduit that's marked "Sealtite" on the cover. Buy it in long lengths and cut it on the job without waste. Special liquid-tight connectors by Appleton, Thomas & Betts, Gedney or Pyle-National are available. Free booklet S-537 gives full information on Sealtite. Write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: Sealtite is approved by Canadian Standards Association, and sold by Anaconda American Brass Ltd., New Toronto, Ont. 56194WE

*Trade Mark †Pat. Applied For



TYPE U.A. Tough, extruded cover protects wiring against moisture, oil, dirt, chemicals and corrosive fumes. Positive ground is afforded by spirally wound copper conductor inside the conduit.

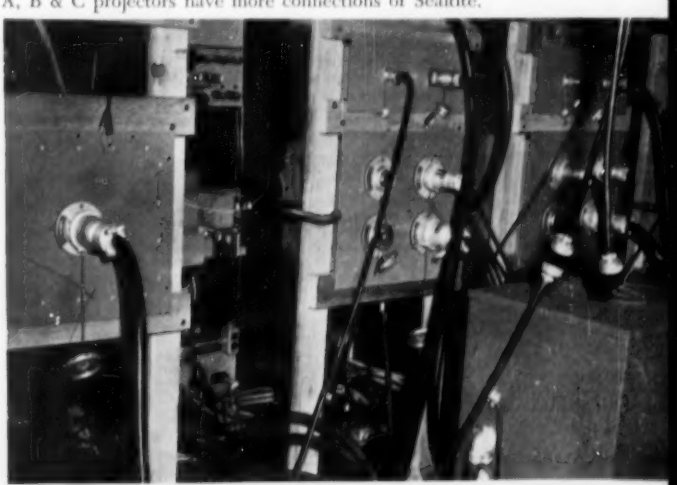
Insist on the original

SEALTITE

an **ANACONDA**® product

CONSOLE distribution box assembly—from which operator can control all units automatically—is connected by 7 Sealtite units.

SOUND, servo and intercommunication feed through assembly for A, B & C projectors have more connections of Sealtite.



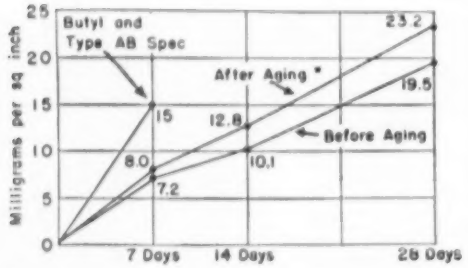
CALL **WESCO**

Amazing moisture resistance of Anaconda's Type AB butyl high-voltage insulation helps reduce failure due to moisture.

When you can't keep cable out of moisture

New insulation keeps moisture out of cable

Exceptional moisture resistance is provided by Anaconda Type AB butyl insulation.



RESULTS OF mechanical moisture absorption test show Type AB retains good moisture resistance even after aging.

Where rubber-type cable is installed in underground ducts or buried directly in the earth, the moisture-resistance properties of the *insulation* are vitally important.

Latest facts show *Anaconda's Type AB butyl high-voltage insulation absorbs far less moisture* than industry standards permit. For the mechanical moisture absorption test, the industry has regarded 15 milligrams increase in weight per square inch of exposed surface, after 7 days' immersion at 70C, as a criterion for satisfactory moisture resistance. Type AB easily meets that requirement – in fact, typical results show it absorbs less than 7.2 mg. in 7 days.

New Engineering Bulletin EB-27 gives you full details on performance of Type AB insulation in 15 Industry Specification tests. Ask the Man from Anaconda for your copy. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

5625WE

Get all the facts on Anaconda butyl. Write today –

ASK THE MAN FROM ANACONDA®

–PIONEER IN BUTYL INSULATION

FOR EVERYTHING ELECTRICAL.

SIGNALING EQUIPMENT?

you name it - we have it

When you need signaling or telephone equipment for a job, you can get everything you need from Auth; you don't have to shop around. And when you offer Auth equipment, your customer knows he is getting a top brand, installed in many of the finest projects in the country.

All Auth equipment is designed to make installation easy and save the contractor valuable man hours. It requires a minimum of servicing and maintenance. For complete literature on the Auth line, write to: Auth Electric Company, Inc., Long Island City 1, N. Y.

Auth
SINCE 1892

Manufacturers of audible signals, push buttons, annunciators, transformers, telephones, mail boxes, and complete signaling systems for hospitals, housing, schools and industry.

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FOR YOUR CUSTOMER'S SATISFACTION...INSTALL

APPLETON

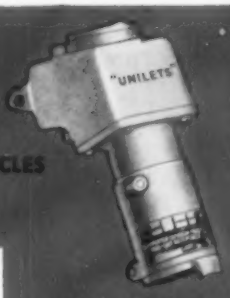
INDUSTRY'S MOST ADVANCED LINE

EXPLOSION-PROOF EQUIPMENT

JUNCTION UNILETS

LIGHTING FIXTURES

RECEPTACLES



Explosion-proof electrical equipment is more important today than ever before. Manufacturers of material handling equipment are adding explosion-proof switches and connectors to machines to be used in hazardous areas. And, an ever increasing number of industrial plants are almost entirely equipped with explosion-proof electrical equipment. APPLETON's full line of explosion-proof equipment offers you the opportunity to capture your share of this new and lucrative market. You need never miss an electrical installation job with APPLETON, because APPLETON is . . .

The Standard for Better Wiring

SWITCHES

LINE STARTER UNILETS

FLEXIBLE COUPLINGS

EXPANSION UNIONS

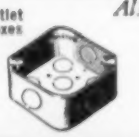
CIRCUIT BREAKER UNILETS

Efficient, one-call "SERVICE BY WESCO" on these items

APPLETON ELECTRIC PRODUCTS

Industrial Lighting

Outlet Boxes



Also Manufacturers of

"ST" Series Connectors

Malleable Iron Unilets & Covers

Automatic Reelites

APPLETON ELECTRIC COMPANY 1704 Wellington Avenue, Chicago 13, Illinois

FOR EVERYTHING ELECTRICAL . .

8 REASONS WHY BERMICO® FIBRE CONDUIT is your BEST CABLE PROTECTION

1. **WATERPROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high, even under toughest conditions.
2. **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.
3. **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!
4. **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.
5. **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.
6. **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport . . . the heavy loads imposed during installation.
7. **TIGHT.** All joints are precision milled for light, speedy, installations.
8. **EASILY HANDLED.** So light in weight that one man can carry several 8-foot lengths at once—lay more per working hour.

Production facilities and schedules are geared to assure prompt shipments

Distributed by

WESTINGHOUSE ELECTRIC SUPPLY COMPANY

Offices in all leading cities

QUALITY

For best cable protection, be sure to specify

BERMICO FIBRE CONDUIT — A PRODUCT OF BROWN COMPANY

Mills: Berlin and Gorham, N. H.; Corvallis, Ore.

For Competitive Prices—Call WESCO—for Quality Electrical Supplies and Service

CALL WESCO

JAMES E. DAVIS, CHIEF ELECTRICIAN
NORTHWESTERN GLASS CO.

"Our Production schedule was frequently disrupted by needless shutdowns on a line of motors . .

until we changed to Fusetron Fuses"

James E. Davis.
CHIEF ELECTRICIAN, NORTHWESTERN GLASS COMPANY
SEATTLE, WASHINGTON

"Ordinary 500 amp. renewable fuses were blowing frequently in a 1000 amp. switch that controls a line of motors ranging in sizes up to 150 hp.

"We work on a tight production schedule, so these shutdowns with men and motors standing idle were costing us a considerable amount of money and trouble.

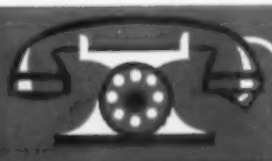
"As chief electrician, the problem was 'thrown in my lap'.

"A study of the situation indicated that harmless surges were causing the fuses to blow.

"We figured that the long time-lag of Fusetron dual-element fuses might correct the trouble.

"They were installed in 1953 and the original Fusetron fuses are still in service.

"We think this is quite a record because the switch is loaded to capacity 24 hours a day 7 days a week, only Christmas and July 4th excepted."



FOR EVERYTHING ELECTRICAL

Here's why Fusetron Fuses give all purpose Protection

A fuse link combined with a thermal cutout - the result, a fuse with tremendous time-lag and much less electrical resistance and an interrupting rating in excess of 100,000 amps.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to same dimensions as ordinary fuses. FUSETRON Fuses fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 amperes, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

Write for bulletin FIS.

THOMAS F. CURRAN
MACHINE OPERATOR

FOR LOADS ABOVE 600 AND UP TO 5,000 AMPS., USE BUSS HI-CAP FUSES . . .

They have unlimited interrupting capacity to handle any fault current regardless of system growth.

They can be coordinated with Fusetron fuses on feeder and branch circuits to limit fault outages to circuit of origin.

Write for bulletin HCS.

FUSETRON DUAL-ELEMENT FUSES DO MORE THAN ELIMINATE DOWN PERIODS CAUSED BY NEEDLESS BLOWS . . .

They Provide 10 Point Protection . . . .

1. High interrupting capacity — protect against heaviest short-circuits. Have proven on tests to open safely on circuits set to deliver in excess of 100,000 amperes.
2. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
3. Protect against needless blows caused by harmless overloads.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect against waste of space and money permit use of proper size switches and panels.
6. Protect motors against burnout from overloads.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Protect motors against burnout due to single phasing.
9. Make protection of small motors simple and inexpensive.
10. Protect coils, transformers and solenoids against burnout.

Play Safe! install FUSETRON dual-element Fuses and BUSS Hi-Cap Fuses throughout entire Electrical System!

BUSSMANN MFG. COMPANY
(Division of McGraw Electric Co.)
UNIVERSITY AT JEFFERSON ST. LOUIS 7, MO.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

1156

CALL **WESCO**

HOW TO CUT POWER DISTRIBUTION COSTS 15 TO 25%

Investigate the benefits of aluminum bus duct—new from Westinghouse. Because it's aluminum you save from 15 to 25% in initial cost.

The same top quality and performance, heretofore obtainable only with copper, is guaranteed—thanks to the new electroplating process which Westinghouse uses to eliminate the dangers of high-resistance splices for all time.

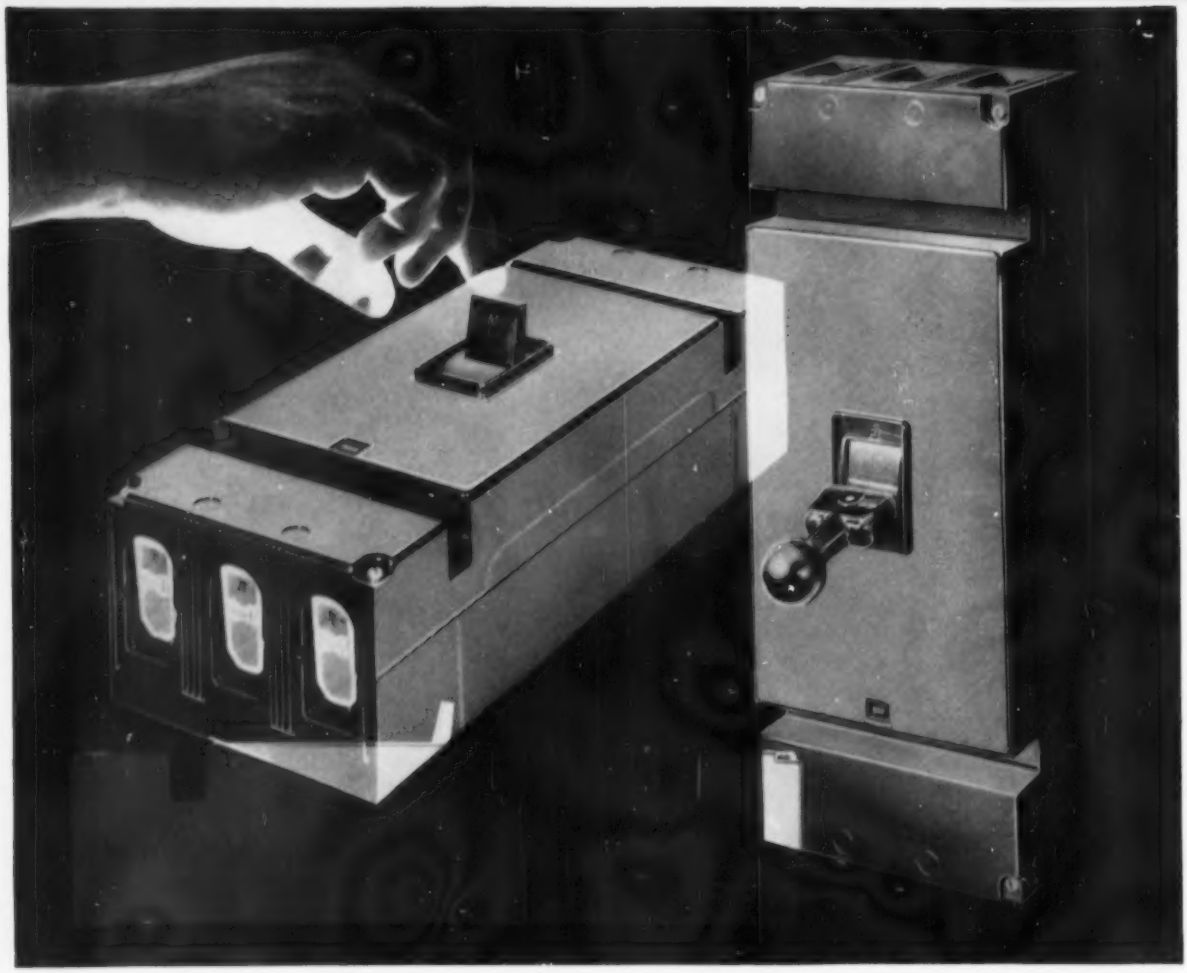
Initial cost savings are not the only benefits. This duct handles and installs faster because it's as much as 35% lighter. And it's prefabricated in many standard shapes, allowing you complete design freedom. Call or write today to Westinghouse, Box 868, Pittsburgh 30, Pennsylvania, for the new book about aluminum bus duct, the modern way to distribute power, B-7003. J-30221

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

FOR EVERYTHING ELECTRICAL . . .

WHAT?
AB-I's cost less than safety switches?
YES!
In many cases Westinghouse AB-I circuit breakers do. And check the other concrete benefits that safety switches can't match.
You realize definite reductions in wiring costs: because the enclosure is installed first and unit breaker wired later, there is no obstruction to pulling wires. At the present-day electrician's rate of pay, this adds up to real dollar savings.
In order not to tie up your capital until breakers are actually needed on a job, you may purchase the enclosure only. Westinghouse unit breakers are sold separately for your convenience.
Don't these reasons prove to you that Westinghouse AB-I breakers are today's best circuit protection buy?
J-30222
WATCH WESTINGHOUSE!
WHERE BIG THINGS ARE HAPPENING FOR YOU!
CALL WESCO



The Westinghouse Type M—only fully rated 800-ampere, molded-case circuit breaker . . .

Saves 3/4 cost of larger devices

Over a year of customer use, as an alternative to larger 800-ampere protective devices, has proved the economical advantage of the Westinghouse Type M AB De-ion® circuit breaker.

Whether you use it singly enclosed or in a switchboard, you'll find it can save ¾ the cost of a larger air circuit breaker. Space or mounting economies may run the savings even higher—such as the use of this design in building compact distribution panelboards.

Though the smallest device of its rating, the new model will carry its full current rating in normal ambients even when enclosed—something other thermal devices cannot do. This feature of ambient compensation is useful in applications where standard units might unduly penalize system capacities. Both the Westinghouse *true 800-ampere* alternate and the standard thermal magnetic trip types are U.L. listed.

You owe it to yourself to get all the facts on the Westinghouse Type M circuit breaker. Get 'em today from your local Westinghouse sales office—or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-30214

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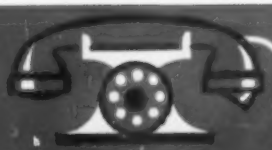
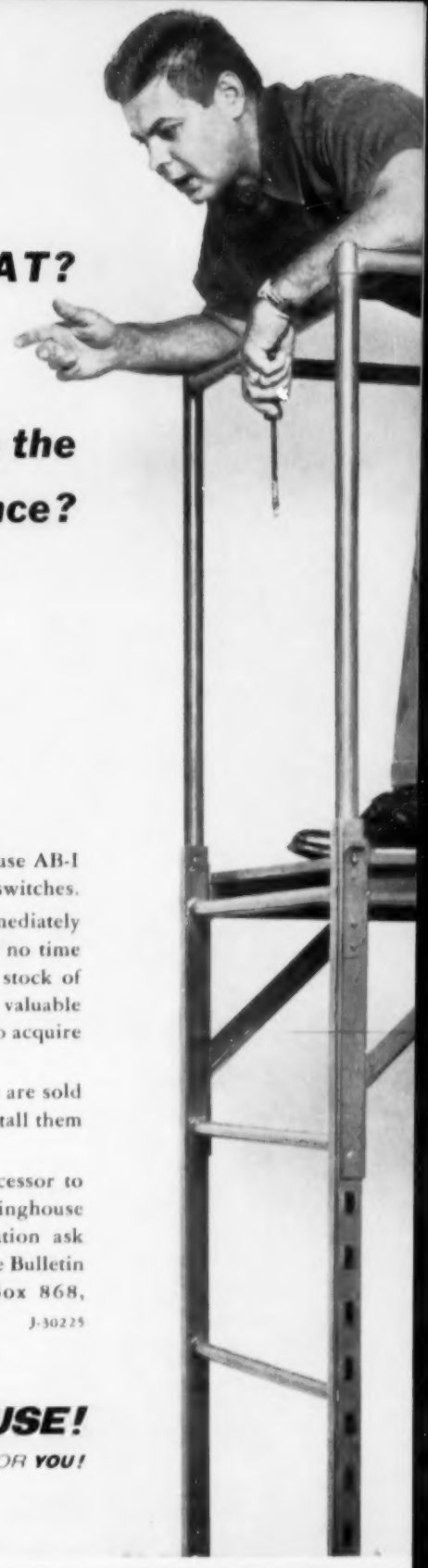


FOR EVERYTHING ELECTRICAL.



WHAT?

AB-I's eliminate the replacement nuisance?

FOREVER. And in many cases Westinghouse AB-I circuit breakers actually cost less than safety switches.

A flip of the handle restores power immediately after faults. With nothing to replace there is no time delay, no maintenance expense. There is no stock of replaceable devices to maintain—tying up valuable floor space. No need for capital investment to acquire such a stock.

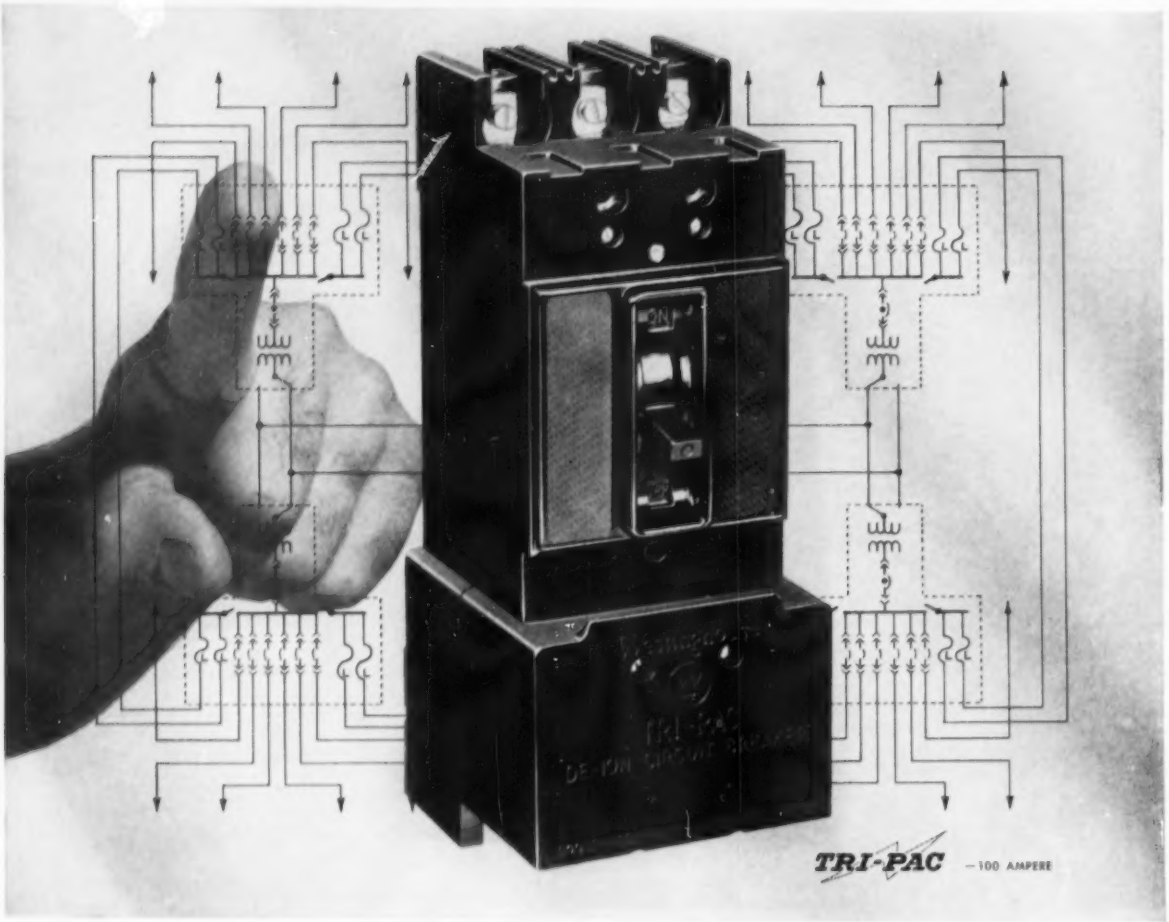
Westinghouse unit breakers and enclosures are sold separately, for your convenience. Buy and install them as desired.

AB-I circuit breakers are the modern successor to the fused switch. Can you afford *not* to use Westinghouse AB-I circuit breakers? For further information ask your Westinghouse distributor for Descriptive Bulletin 30-250 or write Westinghouse, P. O. Box 868, Pittsburgh 30, Pa. J-30225

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU**!*

CALL **WESCO**



100,000 amps gets a new boss—the Westinghouse Tri-Pac breaker

The new Westinghouse Tri-Pac breaker is the smallest protective device for electrical circuits where 100,000 amps can be poured into faults. It is the most practical and economical solution to the constantly increasing interrupting requirements of network systems and those fed by large transformers.

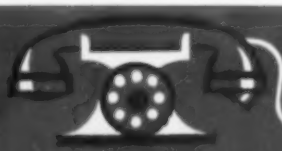
Co-ordinated triple circuit protection—thermal, magnetic, and current limiting—combines the inherent advantages of both the molded case breaker and fusible current limiters. The breaker trip portion of the Tri-Pac handles overloads and moderate faults, eliminating fuse replacement. On higher currents, the current limiters in Tri-Pac trip before the breaker portion, insuring the prompt protection required at high currents.

Tri-Pac costs much, much less than large air current breakers of equivalent rating and provides more safety and convenience than switches combined with fusible elements. New Tri-Pac breakers insure positive protection against all system current faults—large or small—at a new and greater economy.

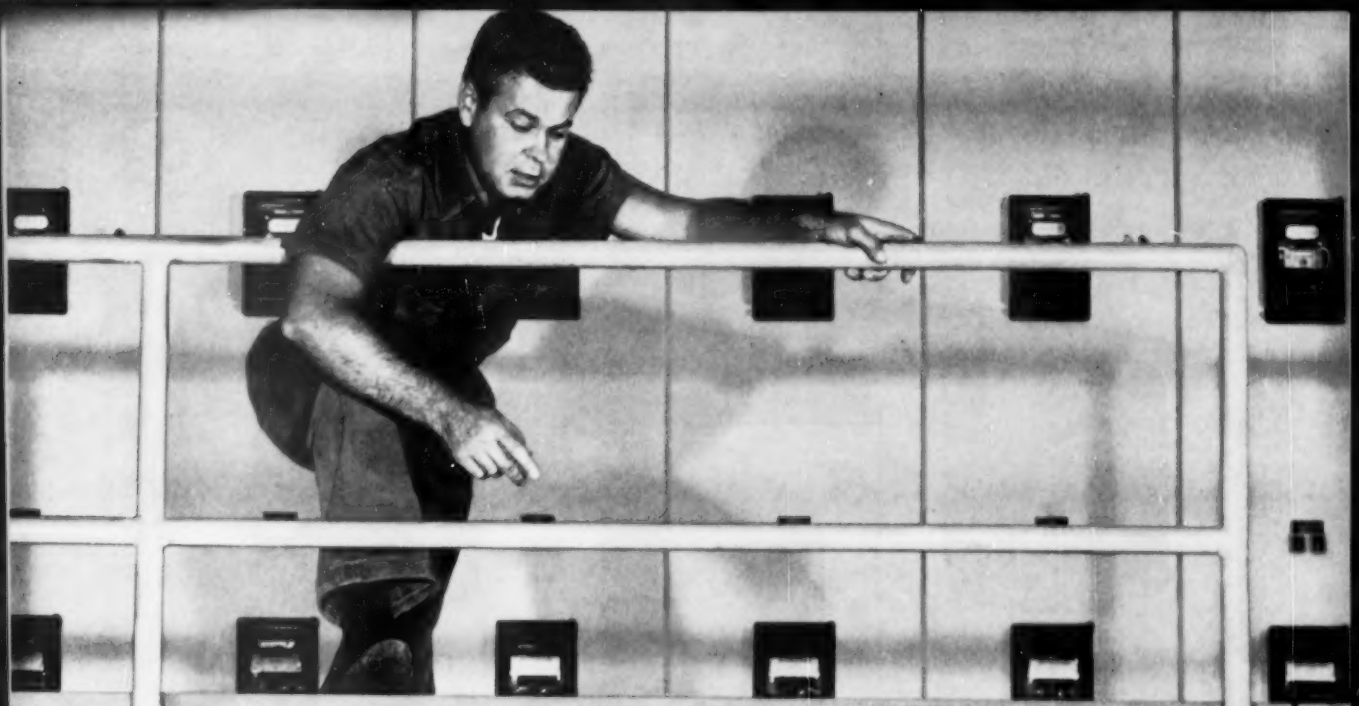
A Westinghouse sales engineer can show you additional reasons why the new Tri-Pac breaker is your best buy for powerful circuit system protection. Call him, today. J-30216-X

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***



FOR EVERYTHING ELECTRICAL.



WHAT?

AB-I's put machines back to work immediately?

LIKE LIGHTNING. And in many cases Westinghouse AB-I circuit breakers cost less than safety switches.

With no fuses to replace, no waiting for authorized personnel to correct the fault, anyone can restore service. A flip of the handle does it. If the fault lingers, the exclusive De-ion® arc quencher goes into action again.

Can you afford the lost production, the lost profit caused by down time, even temporary down time caused by harmless overloads? When fuses blow, temporary faults take just as long to correct as serious ones.

AB-I circuit breakers are the modern successor to the fused switch. No other protective device can match Westinghouse AB-I's for performance, quality and economy. For further information ask your Westinghouse distributor for Descriptive Bulletin 30-250 or write Westinghouse, P. O. Box 868, Pittsburgh 30, Pa. J-30226

CALL **WESCO**

ALL NEW!

No. 9755
New Cord Grip New "Fiberite Face"

No. 5294
New Cord Grip New "Fiberite Face"

No. 5694
New Cord Grip New "Fiberite Face"

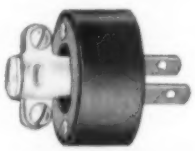
3 New Bryant Cord Connector Bodies Take Full Range of Wire Sizes (.296 to .625 in.)

For use in industrial plants, steel mills, shipyards, garages — wherever there's rugged usage.

These all-new Bryant molded rubber cord connector bodies for the first time permit using the wide range of wire sizes needed in heavy-duty installations. Built to "take it", this new line should be used with the companion caps shown at right.

Listed by Underwriters' Laboratories, Inc.

Use New Cord Connector Bodies With These Bryant Caps Which Also Take Full Range of Wire Sizes (.296 to .625 in.)



CONNECTOR No. 9755
fits Cap No. 9754

CONNECTOR No. 5294
fits Cap No. 5266

CONNECTOR No. 5694
fits Cap No. 5666

Specify Bryant from your Electrical Distributor

THE BRYANT ELECTRIC COMPANY
Bridgeport 2, Connecticut
Chicago • Los Angeles

BRYANT
SUPERIOR WIRING DEVICES

J-9992BC

FOR EVERYTHING ELECTRICAL . .

CRESCENT

ABC ARMORED CABLE, TYPE ACT

With Improved Features

EASIER • QUICKER • SAFER

★ PLASTIC INSULATED CONDUCTORS are clean, easy stripping, with solid, clear colors, and minimum diameter for easier installation in boxes.

★ PAPER TAPE which is tough, moisture-resistant yet easily removed, gives protection to the insulated conductors.

★ INSULATED BUSHING for protection against sharp ends of armor, furnished with each coil of cable.

★ BOND STRIP UNDER ARMOR is used in all sizes. A flattened aluminum bonding wire in contact with the under side of each convolution of the galvanized steel armor assures a permanent, low resistance through armor to ground.

★ PREFABRICATED BREAKING LINES. At intervals of every 1½ inches on CRESCENT ABC Armored Cable you will find a small cut mark. This cut mark shows the location of a prefabricated breaking line inside the armor.

Only a few short strokes of a hacksaw guided by the cut mark are required to cut through ONE outer ridge, and a bend by hand severs the armor. By actual test, this saves 30% of the time ordinarily required. A clean separation results, with no sharp edge. There is no chance of injury to insulation because only one OUTER ridge is cut.

The prefabricated breaking lines in the armor are so made that THERE IS NO REDUCTION of tensile strength, bending qualities, crushing resistance or electrical conductivity. This armor construction meets all requirements of Underwriters' Laboratories.

CRESCENT WIRE & CABLE

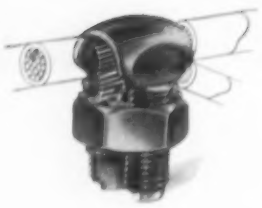
OVER 70 YEARS EXPERIENCE

CRESCENT INSULATED WIRE & CABLE CO.

Trenton, New Jersey

CALL **WESCO**

for CONNECTORS...



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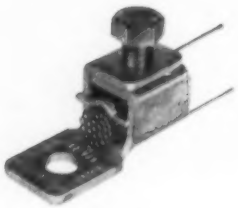

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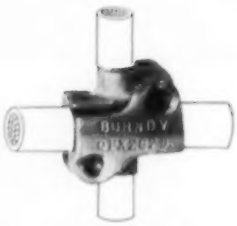

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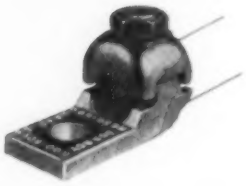

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IT ALWAYS PAYS TO CONSULT

BURNDY

YOUR BASIC SOURCE
FOR LATEST DEVELOPMENTS
IN ELECTRICAL CONNECTORS

BURNDY
REPRESENTATIVES
IN PRINCIPAL CITIES

With more than 30,000 individual Burndy connector designs—Burndy is ready to serve your connector needs promptly, efficiently.
70 graduate engineers will help you solve any connector problems in joining, terminating, clamping, or grounding every size and type of electrical conductor.

Burndy connectors and tools provide maximum mechanical strength and electrical efficiency —at low installation cost.
Write for free technical counsel or catalogs . . . to

BURNDY—NORWALK, CONNECT. · FACTORIES: NEW YORK · CALIFORNIA

53-14

FOR EVERYTHING ELECTRICAL . . .

ECON'S exclusive STOP-WATCH ACTION MAKES THE BIG DIFFERENCE

When current overload is continued beyond the safe and pre-determined time, exclusive Econ-Alloy breaks the circuit by changing directly from solid to liquid. The usual plastic stage is eliminated, insuring faster, more accurate protection against overloads and shorts . . .

ECON-ALLOY makes the DIFFERENCE

- Stops needless fuse blows safely
- Complete protection against shorts and dangerous overloads
- Cuts fuse costs and downtime

ECON® DUAL-ELEMENT cartridge fuses

You protect against needless fuse blows yet get faster, more accurate protection against shorts and dangerous overloads when you use ECON Dual-Element Fuses. The exclusively different breakaway action of the ECON-Alloy element gives you this important advantage.

The ECON-Alloy thermo element has a double stop-watch action. First, it acts instantly on shorts. Second, with its pre-determined delayed timing, it safely handles overloads—up to 500%—without blowing.

Available in knife and ferrule types: 0 to 600 amperes, 250 and 600 volts. Underwriters' Laboratories Inc., approved.

Write for ECON Dual-Element Catalog S-60 . . . or complete line folder on all Economy Fuses

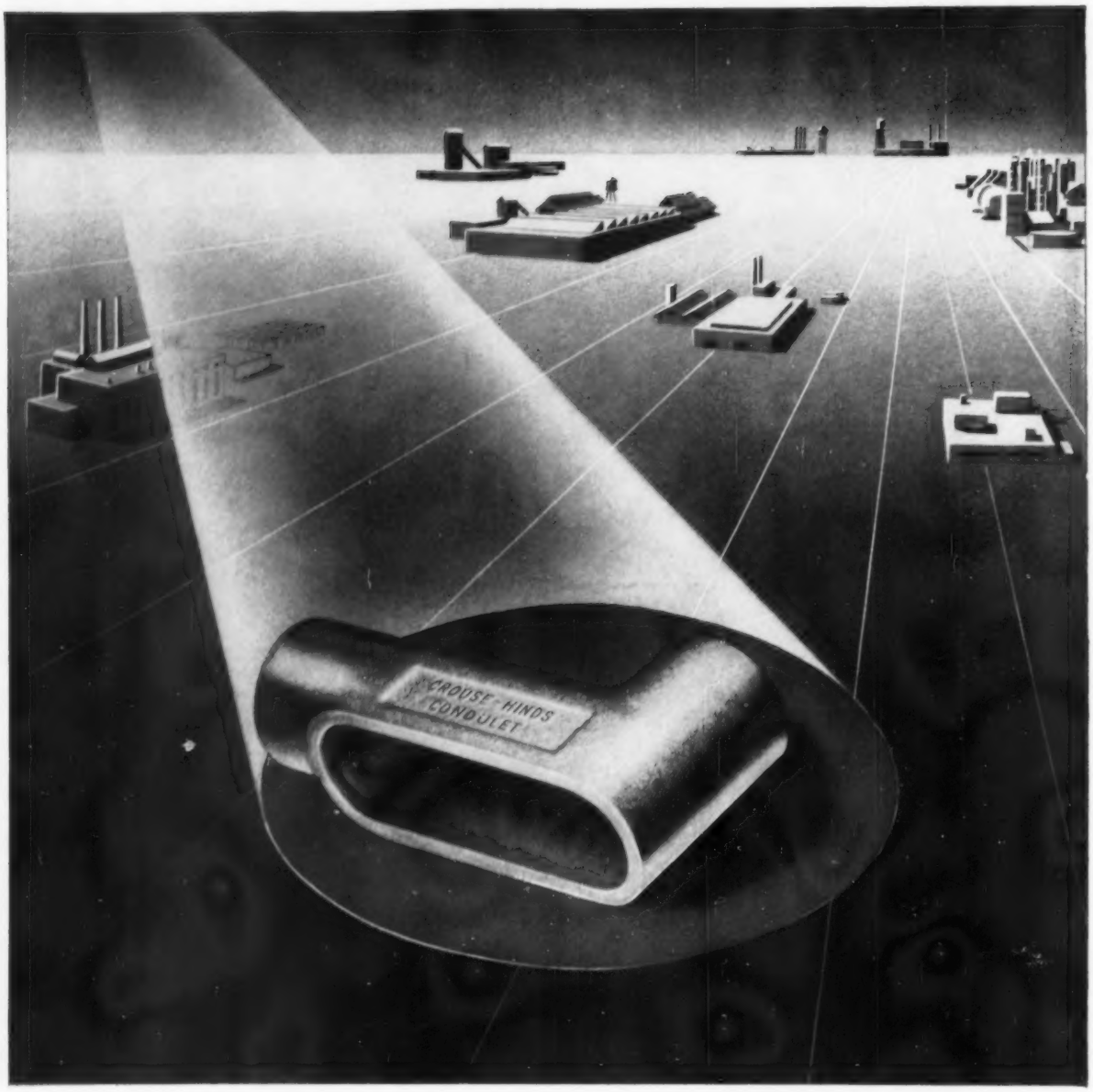
ECONOMY FUSES FOR EVERY PURPOSE

B-1458

Ask your ELECTRICAL WHOLESALER for ECON Dual-Element and other Economy Fuses.

ECONOMY FUSE & MFG. CO., 2717 Greenview Avenue, Chicago 14, Illinois

. . . CALL **WESCO**



Still the standard of quality in rigid conduit fittings

Condulets* have been widely imitated since Crouse-Hinds introduced them more than 40 years ago . . . *and that's all to the good!*

Imitation by others has kept us on our toes . . . made us constantly improve our product to stay *ahead* of competition.

As a result, most conduit fittings today incorporate many basic features pioneered by Crouse-Hinds—but lack certain refinements that put Condulets in a class by themselves, head and shoulders above the rest.

What other fittings, for example, include these improvements:

. . . an ingenious *Cover* design that eliminates protruding screws or ears in the housing—common causes of cable damage.

. . . a longer *Hub* that permits full tightening of conduit and fitting without causing conduit to bottom on the integral bushing.

. . . a corrosion-resistant Feraloy *Body* plus a triple-layer *Finish* that exceeds Federal and UL specs. for lasting protection.

These years-ahead Condulet features have yet to be equalled. You get them in all 45 types of Obround Condulets ranging in size from ½" to 6". See your Crouse-Hinds distributor. Crouse-Hinds Company, Syracuse 1, New York.

*Registered

CROUSE-HINDS COMPANY

FOR EVERYTHING ELECTRICAL . .

"insure" every job with an EDWARDS quality product

You're responsible for every installation you make—from the simplest transformer to the most complicated electric signaling system. No need to take a chance when there's an Edwards quality product for every signaling job you do—in schools, hospitals, industrial plants, buildings and residences.

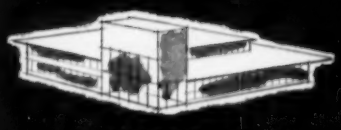
Edwards simplified design—the result of 80 years specialization—will make installation easier, less expensive, and keep call backs to a minimum.

Edwards famous products and systems are presold to all your customers...so insist on the name Edwards to protect and build your good reputation.

See your Edwards Technical Specialist or Distributor or write Dept. EC-11, Edwards Company, Inc., Norwalk, Connecticut. In Canada: Owen Sound, Ontario.

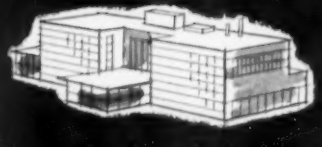
for homes

door chimes
home fire alarm systems
bells, buzzers, electric accessories
push buttons • burglar alarms



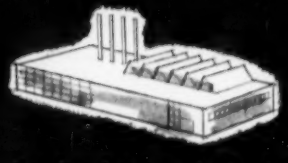
for schools

clock & program systems
fire alarm systems
bells, horns, buzzers
intercommunication systems



for hospitals

nurses call systems (audio, visual)
doctors' paging systems
fire alarm systems
in-and-out registers
psychopathic alarm systems
contact devices



for business—industry

lokator® paging systems
clock & program systems
fire alarm systems
intercommunication systems
burglar alarm equipment
bells, horns, buzzers
executive desk call buttons
contact devices • door openers
annunciators

Specialists in signaling since 1872

EDWARDS

DESIGN • DEVELOPMENT • MANUFACTURE

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Efficiency

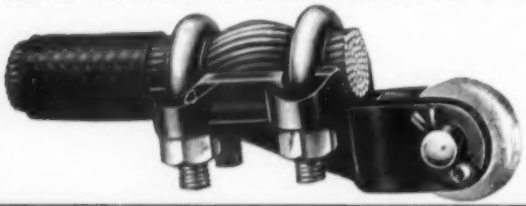
SUSPENSION DEVICES

ARE TIME AND COST SAVERS

By eliminating the need for punching, drilling or burning through beams in order to hang electrical mountings . . . Efficiency Suspension Devices can save you time and expense on practically every construction job.

CABLE STRAIN CLAMP

Capable of withstanding a direct pull of over 12,500 lbs. before slipping, this clamp can be furnished either with eye or clevis. Three clamp sizes accommodate all cable sizes from 1/0 to 1,500,000 c.m. Constructed of malleable iron, this clamp has a high ridge across the center of the cable channel and a U-bolt at each end.



BUSHING MESSENGER SUPPORT

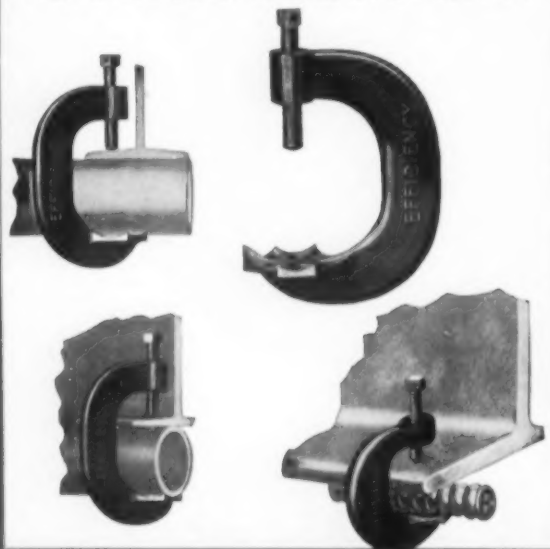
This support is designed to suspend wire or cable from messengers where beam mounting is not possible. This support is a combination of our Type G Bushing Support with strip steel messenger attachment. Furnished complete with malleable iron support, steel messenger attachment and all bolts, as illustrated.

NON-ADJUSTABLE INSULATOR SUPPORT

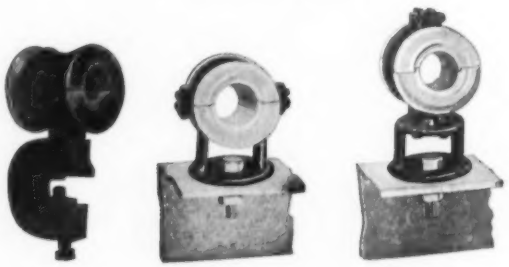
ADJUSTABLE INSULATOR SUPPORT

CONDUIT HANGERS

Correctly designed for carrying armored cable or ½" to 2½" pipe along open steel construction. Radiating ridges and the five point gripping surface keeps the pipe suspended dead center, with the set screw above permitting the cable or pipe to be carried at any angle. Made of highest quality malleable iron.



BUSHING SUPPORTS



TYPE G — TYPE VG — TYPE VB

Designed to eliminate the drilling of holes for mounting, these supports are adjustable to any angle. Made of malleable iron with highest quality split porcelain, they are furnished for AC-DC service to handle 5/16" to 2¾" cable. Type G is clamp-mounted, while Type VB and VG bolt mounted through its circular base.

BUSHING RACKS AND SUPPORTS

Available in 2, 3, 4, 5 and 6 bushing racks for AC or DC service. Only a single bolt is required to support the bushing and clamp the support to the rack. For 5/16" to 2¾" wire sizes.

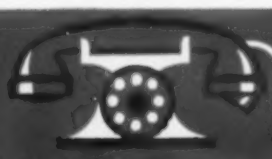
NESTED BUSHING RACKS AND SUPPORTS

Simply and compactly designed to carry conductors equidistant from center to center. Each bushing is a separate unit, allowing independent installation of each cable line. Available in 2, 3, 4, 5 and 6 bushing racks.

EFFICIENCY ELECTRIC AND MANUFACTURING COMPANY

Write for Catalog

East Palestine, Ohio



FOR EVERYTHING ELECTRICAL . .

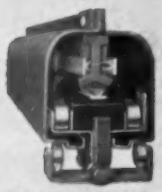
SAFE
RUGGED
DEPENDABLE
ECONOMICAL

ELECTRIC FEEDRAIL®

moving power systems

go where the "loads" go!

FEEDRAIL "60" – For light hoists, cranes, small portable tools, lighting, business machines, cutting and sewing equipment. Continuous rating – 60 amperes. Send for Bulletin No. 45.



FEEDRAIL "100"– For cranes and hoists, portable tools, production and test lines, machine tools, airport hanger doors. Continuous current rating – 100 amperes. Send for Bulletin No. 50.

FEEDRAIL "HEAVY DUTY" For heavy duty cranes and hoists, large machine tools, conveyor assembly lines. Continuous current ratings – 225, 375 and 500 amperes. Send for Bulletin No. 35.

A FEEDRAIL "moving power system" lets you deliver power where you want . . . when you want it. Designed to *go where the loads go,* FEEDRAIL feeds power through smooth-riding, engineered trolleys to provide outlets *anywhere* along the line.

Since 1935, FEEDRAIL has proved the safest, most dependable way to distribute power to mobile equipment. Basic designs remain unchanged because no other systems offer comparable safety and dependability. And here's why:

1. Steel enclosed design eliminates accidents –
2. Unfailing reliability prevents costly service interruptions due to wiring failure –
3. Heavy-duty construction withstands hard usage, keeps maintenance costs down.

INSTALLATION NO PROBLEM: Track sections are prefabricated of heavy guage steel in practical lengths. Precisely constructed for fast installation, FEEDRAIL offers no problems – even where curves are involved. And FEEDRAIL can be readily extended, modified or relocated.

INFORMATION FOR YOU: Your local Wesco representative can show you how easily the right FEEDRAIL system can be installed in your plant. See him for details or write Feedrail – Dept. C11.

Never Becomes Obsolete

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

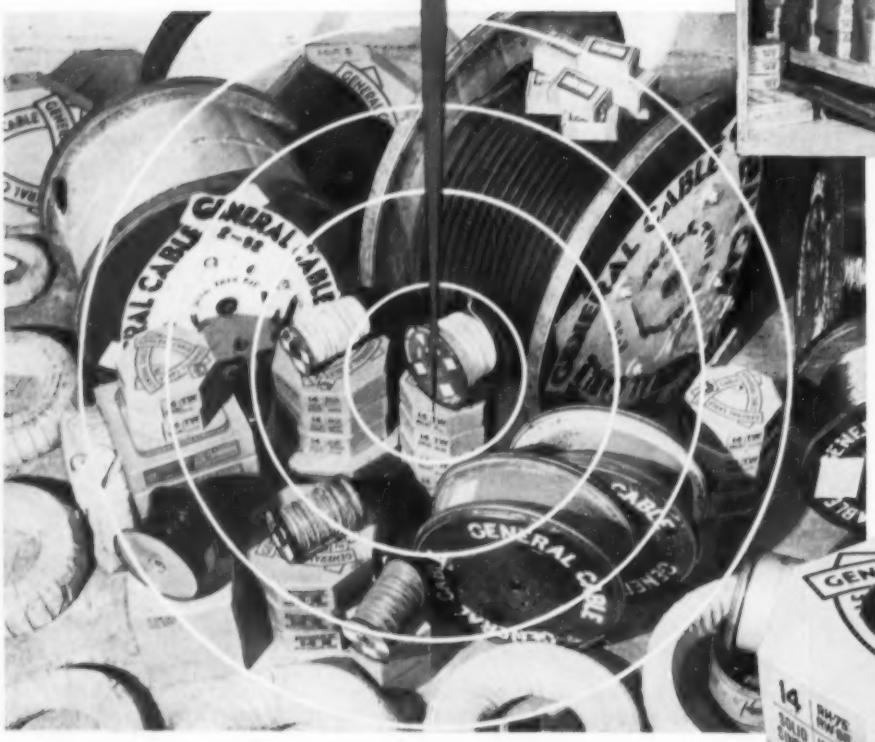
125 BARCLAY STREET • NEW YORK 7, N. Y.

ELECTRIC FEEDRAIL®

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

CALL **WESCO**

GENERAL CABLE HITS THE TARGET on Delivery and Service!



Making your job easier and better, General Cable backs up distributors unconditionally with 'round-the-clock support, hits the target with quick delivery and dependable service on every job. GENERAL CABLE CORPORATION, 420 Lexington Avenue, New York 17, New York.

be specific . . . **specify GENERAL** **CABLE**

FOR EVERYTHING ELECTRICAL . . .

new LIGHTWEIGHT Greenlee Bender

easy portability . . .
extra versatility . . .
extra power . . . 15 tons!

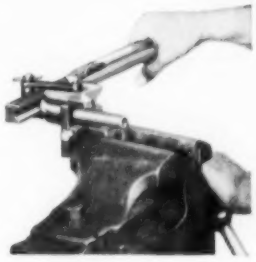
Here's the kind of real portability you've been looking for in a bender for ½" to 2" conduit. New GREENLEE No. 880 Hydraulic Bender of advanced type construction is unusually *lightweight*, yet extra rugged, fast, *powerful*. Easily carried by one man . . . easily operated by hand, or can be used with a power pump for fast production jobs. Makes complete 90° bends with one ram stroke. Quickly pays for itself in time and materials saved. Get complete details from your electrical distributor.

TOOLS FOR CRAFTSMEN

GREENLEE

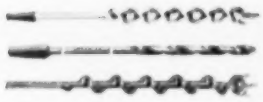
Knockout Punches and Hydraulic Punch Driver

Quick, easy way to make knockout enlargements for ½" to 4" conduit. Simply insert GREENLEE Knockout Punch in knockout or small drilled hole, then turn with an ordinary wrench. For an even faster, practically effortless operation, drive Punch with powerful, portable GREENLEE Hydraulic Driver shown below.



Hand Benders for Tubing

Swiftly produce accurate small-radius bends (up to 180°) in conduit, pipe, and tubing. No flattening or kinks. GREENLEE Hand Benders are especially designed to form neat bends to fit sharp corners, nooks, and other close quarters. Eliminates need for many manufactured bends and fittings. Various sizes and models . . . handy companion tools to GREENLEE Hydraulic Benders for quickly "custom making" your own complete conduit installations *right on the job*.



Boring Tools For quickly making clean, smooth openings for conduit and wiring. The GREENLEE line includes Electricians' Auger Bits and Electric-Drill Bits, Bell Hangers' Drills, Expansive Bits, and Bit Extensions.

Cable Puller Easy-operating, compact unit for 3,500-pound pull. Fastens directly to conduit for pulling in line with conduit . . . on loosened hangers. Attachment available for concealed conduit work.

SEE YOUR ELECTRICAL DISTRIBUTOR. Get complete information on the above and other GREENLEE time-saving tools: Auger Bores • Knock Chassis Punches • Anchor Screw Expanders • Chisels and Gauges • Spiral Screw Drivers • Electric-Drill Bits • Automatic Push Drills • and many more. Greenlee Tool Co., 1751 Columbia Avenue, Rockford, Illinois.

. . . CALL WESCO

On Any Wiring Job...
You Can and Will Cut Cost with
IDEAL WIRING TOOLS

This has been proved by contractors from coast to coast! IDEAL helps the man *on the job* — to do a *better job* faster and easier!

IDEAL offers one of the broadest lines in the whole electrical industry. It enables you to get — and depend upon — everything in electricians tools from one dependable source — a leader for more than 30 years! *You can't do better.*

JUST for example!

IDEAL "E-Z" STRIPPERS

Used more, liked more and *sold more* than any stripper we know of. Rugged, all-steel and as easy to use as pliers. They are so designed that they can't damage wire or crush stranded wire ends, because of their automatic lock. Replaceable blades are of hardened steel. Six models handle all wire gauges from No. 8 to No. 26, also 300 ohm TV down lead and most nonmetallic sheathed cable. *The stripper for heavy-duty work.*

IDEAL Strippmaster®

(Patented, No. 2,523,926)

Strips like lightning — and so easy to use! Especially designed for lighter stripping where speed is all-important.

IDEAL VOLTAGE TESTER

The Super-Safe Tester You Can Bet Your Life On!

This is a voltage tester that protects you two ways! It has both a neon test lamp and a calibrated solenoid indicator . . . each independent of the other. No chance of failure to detect voltage. Handy center mount for the prod keeps the indicator always in the line of vision. Case is of double strength seamless plastic, with no external metal. Molded prod handles have "No-Slip" safety rings, are mounted on 30" leads. Prods when not in use are completely shielded in case. Tests 110 to 550 volts AC — 110 to 600 volts DC.

IDEAL FISH TAPE, REELS and PULLERS

The *big* grip that takes most of the work out of fishing. Actually lets you do the job in 50% of the time as compared to hand fishing . . . like an extra arm or bigger muscles. And they may save your life — because the tape is always in reel or conduit. It can't ever spring loose into "hot" wires or moving machinery. Also, no cuts, skinned fingers or lost time! 50 to 200-foot lengths — all tapes of finest oil tempered flat spring steel.

and to make "fishing" still easier

Get the NEW IDEAL FISH TAPE WINDER

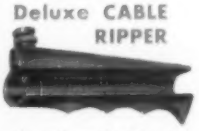
Just roll it around your IDEAL Fish Tape Reel. Spreads the Reel housing, so that Tape reels in or out much more easily. Just rotate the handle. Double rollers hold the Winder in place. Three sizes fit all IDEAL Reels.

IDEAL WIRE LUBE

Still another labor saver!

IDEAL Wire-Lube actually lubricates wires and cables just like the oil you use in your car to lubricate bearings. It lets you slide wires into or out of conduit easier, dries to a fine powder, is as gentle on your hands as a fine soap. It is non-combustible, non-corrosive. For use on rubber, lead or plastic covered wire or cable. Available in 1 quart cans to 5-gal. pails.

IDEAL Deluxe CABLE RIPPER



A real mechanic's tool, built to last for years. It rips the outer sheath from non-metallic cable instantly. It is inserted into the ripper from the side—no positioning, no threading into cutters. Depth of cutting blade is adjustable for various cable sizes. Handles cable up to ½" O.D.

NEW IDEAL WIRE GUIDES

(Patent Pending)

A new IDEAL exclusive, designed to prevent kinking of wire and to make it easier to slide several conductors into conduit without skinning either knuckles or the wire. Tempered steel spring forms a smooth bend for the wire to follow. Knurled aluminum fitting can be used with all types and sizes of boxes. In any position — with plaster rings on or off. ½", ¾", 1" and 1¼" sizes, completely assembled and ready for use.

IDEAL

IDEAL INDUSTRIES, Inc.

1041 Park Avenue, Sycamore, Illinois

FOR EVERYTHING ELECTRICAL.

Service by

WESCO

helps

maintain an

"Air of Efficiency"

with

ILG

PROPELLER FANS

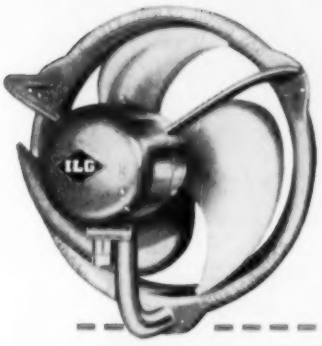
• faster air change • minimum maintenance

• lower power costs

Efficient operation calls for efficient ventilation . . . ILG ventilation! Equipped with self-cooled motors, Ilg Propeller Fans assure you longer, trouble-free, dependable performance. Rated and certified under standard testing codes, you can count on Ilg Fans to move more air. Dynamically balanced fan wheel, direct-connected to motor, assures smooth, quiet, free-running operation. And Ilg's famous "one-name-plate" guarantee covers both fan and Ilg-built motor as a unit.

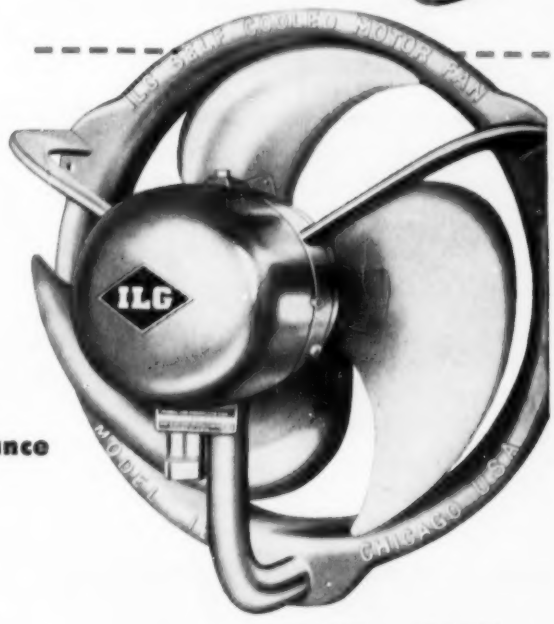
You can choose an Ilg Fan from a complete range of sizes . . . 6" to 72". And you can expect fast delivery, too, because adequate stocks of Ilg Fans are maintained everywhere. You'll find experienced ventilating experts in all principal cities . . . ready and able to solve your air-moving problems. See your dealer, or write . . .

ILG ELECTRIC VENTILATING CO.
2879 N. Pulaski Road, Chicago 41, Illinois



TYPE "P"—high speed, maximum air volume within minimum dimensions. For use on systems up to .6" static pressure. Self-cooled motor. 4 sizes.

TYPE "W"—for large diameter wheels, 60" to 72" sizes. Dynamically balanced wheel. Rigid, sturdy frame. Self-cooled motor.

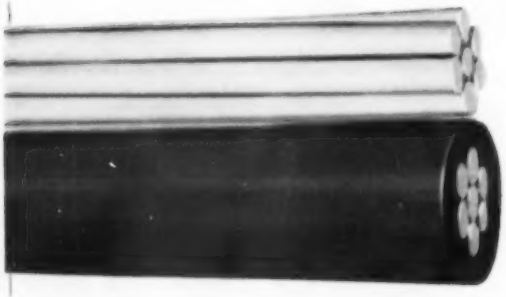


TYPE "Q"—powerful, quiet, efficient . . . plus long life, minimum maintenance. Self-cooled motor. 6" to 48" diameter wheels.

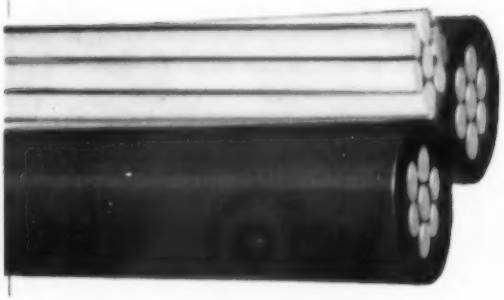
TYPE "X"—has TYPE "Q" wheel and ball bearing, explosion-proof motor. Non-ferrous frame. 16 capacities.

CALL WESCO

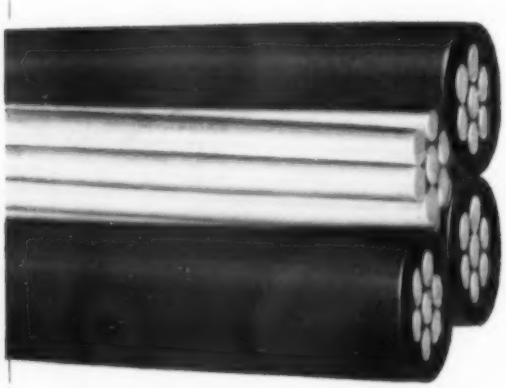
WEATHERPROOF



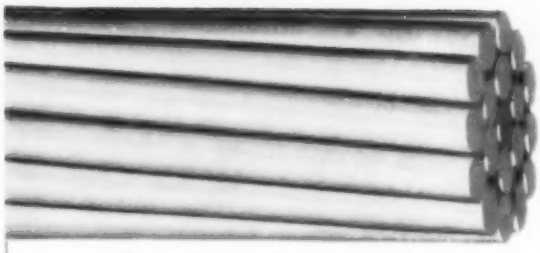
DUPLEX



TRIPLEX



QUADRUPLEX



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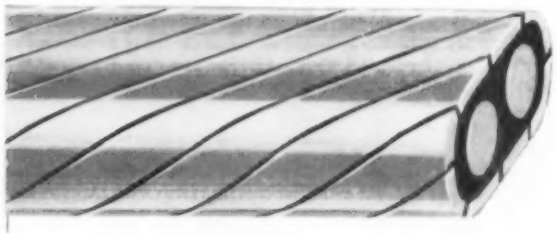
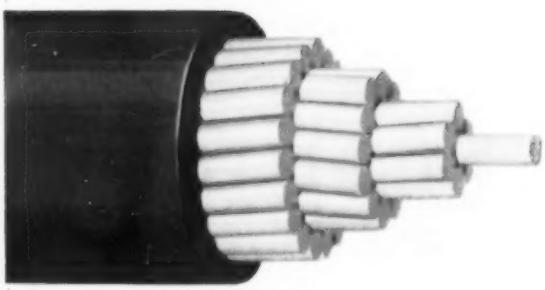
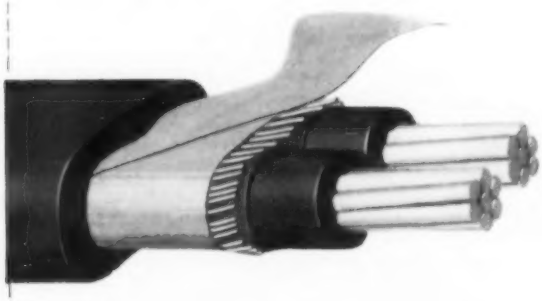


ARMORED SERVICE DROP

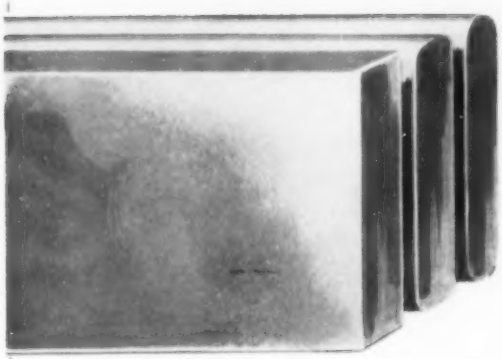


BUILDING WIRE

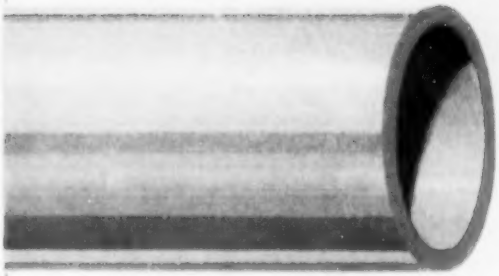


SERVICE ENTRANCE CABLE

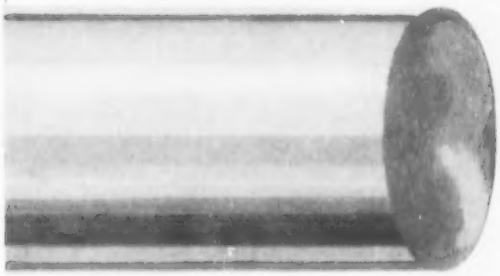
FOR EVERYTHING ELECTRICAL . . .



RECTANGULAR BUS CONDUCTOR



TUBULAR BUS CONDUCTOR



SOLID BUS CONDUCTOR

YES, your local WESCO branch carries it!

Your nearby WESCO branch carries a *wide range* of the KW products shown here. And—equally important—WESCO delivers the same day you call! So why not take full advantage of this convenient local source of supply? A telephone call will do it.

Kaiser Aluminum

KAISER KW WIRE FOR GOOD DISTRIBUTOR SERVICE

Aluminum is the answer to Adequate Wiring

CALL WESCO

the complete source for all your time switch needs

Intermatic®

FOR FASTER INSTALLATION, BETTER PERFORMANCE, LONGER LIFE

NEW MODELS

For 7 day operation—Provides a program of operation individually timed and preset for each day of the week . . . completely skips any days desired. Ideal for heating systems, air conditioning systems, lights, fans, etc. SERIES V21000

For 2 circuit control—Enables switching of two load circuits at different times with one switch . . . for apartment building hall and entrance lights, commercial indoor-outdoor lighting combinations, process timings, ventilating systems, etc. SERIES V22000

For precision short interval switching—Intermittent 24-hr. control, with precision timings in multiples of 5 or 15 minute intervals. For recorded music in stores, offices and factories, process timings, fans, ventilating systems, etc. SERIES V27000 "Supervisor Deluxe".

For bells, signal lights, buzzers, process timings, etc.—1 to 288 daily operations, at any 2½ minute interval (or multiple of 2½ min.). Controlled devices operate from 2 to 60 seconds, as desired. Also available for skipping selected days. SERIES V28000 and V29000 "Schedular".

For 1 to 12 on-off operations within 12 minutes—ON operations from 10 sec. to 11 min. 10 sec. OFF operations from 50 sec. to 11 min. 50 sec. For process timings, fans, pumps, poultry foggers. SERIES C8301-S "Cycler-12".

For 1 to 96 on-off operations every 24 hrs.—Ideal for applications requiring intermittent operation in 15 minute increments, such as recorded music, process timings, fans and heaters, oil well pumping, poultry feeders. SERIES T960 "Supervisor".

POPULAR STAND-BYS

For Standard ON-OFF Operations—Series TS60. Single pole, double pole, single throw, double throw, and portable plug-in models . . . 1 to 12 on-off operations a day . . . timings from 1 to 23 hours . . . manual control with automatic reset . . . heavy duty . . . rated 35 amperes.

For Skipping Operation on Selected Days—Series TS66. "Skipper". Skips automatic operation on weekends, holidays or any selected days . . . available in complete line of poles and throws . . . 1 to 12 on-off operations a day . . . timings from 1 to 23 hours . . . rated 35 amperes.

For ON-OFF Cycles from 5 to 60 minutes—Series T670. Up to 14 on-off cycles a day . . . each cycle independently adjustable from 5 to 60 minutes . . . use as single pole with normally open or closed contacts, or single pole, double throw . . . 35 amperes.

For Automatic Control of Room Air Conditioners — Series P690. Portable, plug-in . . . 1 to 11 operations a day . . . timings from 1 to 23 hours . . . Model P691 has adapter for male plug which permits use on either single phase 2 wire system or single phase 2 wire system with grounding wire. For air conditioners up to 1 horsepower.

For Poultry House Lighting—Model TS60PS dimmer switch model for morning and evening or evening only lighting. Model TS60SP. Single Pole, single throw for morning or all night lighting. Also available for portable plug-in use.

APPLIANCE TIMERS

TIME-ALL . . . Portable, plug-in timer for the home . . . turns appliance and lights on and off automatically . . . controls lights, radios, electric coffee-makers, defrosts refrigerators, etc.

TIME-MINDER . . . Combination electric clock and signal timer . . . timings from 1 minute to 4 hours . . . buzzer sounds at end of time period until shut off manually . . . spruce green case. Model A301

CLOCK TIMER . . . Combination electric clock and appliance timer . . . controls tape recorders, roasters, etc. . . . timings from 15 minutes to 5½ hours . . . cord set and receptacle . . . spruce green case. Model A401

ANOTHER INTERMATIC EXTRA

FLUSH MOUNT CASE

RAIN-TIGHT CASE

Many Intermatic models are available in a flush mount case where a recessed, "finished" appearance is wanted — or in a U.L. approved rain-tight case for complete protection against rain, snow, sleet, hail.

write for catalog 116-Bt

Intermatic. TIME CONTROLS

Mfg. by **INTERNATIONAL REGISTER CO.,** 2624 W. Washington Blvd., Chicago 12, Ill.

YOU CAN *Depend* ON INTERMATIC

FOR EVERYTHING ELECTRICAL . . .

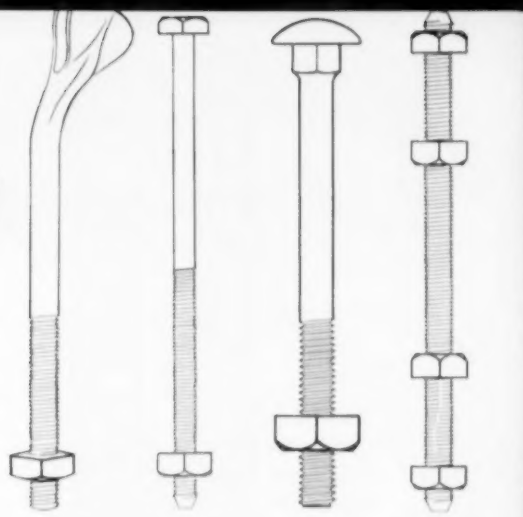
COMPLETE

JOSLYN

POLE LINE EQUIPMENT

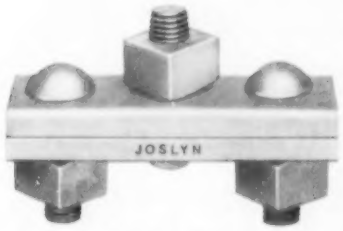
IS AVAILABLE EXCLUSIVELY AT YOUR LOCAL WESTINGHOUSE ELECTRIC SUPPLY CO.

JOSLYN MFG. AND SUPPLY CO.
Executive Home Offices: 155 North Wacker Drive
CHICAGO 6, ILLINOIS



Angle Thimbleye Bolt | Machine Bolt | Carriage Bolt | Double Arming Bolt

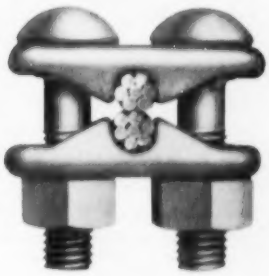
J768 3 Spool Secondary Rack



J931 3 Bolt, 6" Guy Clamp

JO341 Crossarm Clevis

Fetter Drive Lag



Tubase Guy Clip

JOSLYN Mfg. and Supply Co.
155 North Wacker Drive, Chicago 6, Illinois

CALL **WESCO**

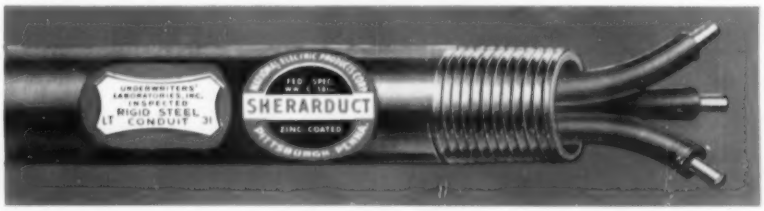
WHICH ONE

...for the safety of your installation?

Yes, both are rigid steel electrical conduit—but that's where the similarity ends! The National Electric Sherarduct conduit (on the left) is different in one vital way—it is lifetime protected by the unique Sherardizing process of dry galvanizing which actually alloys pure corrosion-proof zinc to the steel walls—threads and all. That's why you'll never see Sherarduct deteriorate like ordinary conduit (on the right). For thousands of structures, this Sherarduct protection has meant conduit life way beyond the life of the building.

A Sherarduct installation is the true mark of a quality wiring job. It means positive protection of the electrical system with no costly conduit replacements due to corrosion. Remember these factors—and what they can mean to your installation. Make sure NE Sherarduct is specified for your job.

Sherardizing is Galvanizing at its Best!



Sherarduct is Galvanized Conduit at its Best!

National Electric Products

PITTSBURGH, PA.

3 Plants • 10 Warehouses • 36 Sales Offices

NATIONAL ELECTRIC PRODUCTS — WIRING SYSTEMS — WIRES AND CABLES

FOR EVERYTHING ELECTRICAL.

There's an EVEREADY BRAND Flashlight and Battery

Tailored for every industrial job—right here...

Standard Flashlight Types

No. 2251. TWO-CELL AUTOMATIC SPOTLIGHT
Chrome finish with black decoration. No. 1 seller.

No. 7251P. TWO-CELL SQUARE SPOTLIGHT
All-chrome finish. Unbreakable safety-glow lens-guard.

No. 8251. END-LOADER AUTOMATIC SPOTLIGHT
All-chrome finish. Removable bottom cap. Ring-hanger.

No. 220. LARGE PENLITE
Heavy-duty type with all-chrome finish . . . pocket clip.

TWO-CELL HEAVY-DUTY SPOTLIGHT

No. 1251A — Rugged insulated case (ethyl cellulose) *will not* shatter, crack or dent. Withstands deterioration from water, oils, greases, gasoline, alcohols and acids. Unbreakable safety-glow lens-guard. Also available in three-cell size . . . No. 1351A.

TWO-CELL SAFETY SPOTLIGHT

No. 1259A — Same as 1251A with extra safety features; extra lamp in bottom cap. Approved by U. S. Bureau of Mines and listed by Underwriters Laboratories, Inc. Also available in three-cell size . . . No. 1359A.

"EVEREADY" No. 950 BATTERY
Gives ideal balance of long shelf-life and service-life for all applications, except extreme heavy-duty uses where "Eveready" No. 1050 is recommended.

"EVEREADY" No. 1050 INDUSTRIAL FLASHLIGHT BATTERY
Delivers twice the usable white light of any previous "Eveready" flashlight battery. Engineered for heavy-duty use.

"EVEREADY" "IGNITOR" DRY CELL No. 6
Outstanding recuperative power . . . ideal for ignition, radio, bells, buzzers, electric games, toys, lanterns, etc.

"EVEREADY" No. 409 LANTERN BATTERY
Dependable, long-lasting . . . fits railroad and most popular industrial types of hand lanterns.

"EVEREADY" No. D-99 HEAVY-DUTY FLASHLIGHT BATTERY
New inside-out design for plus power, longer life, dependability for day-in, day-out heavy duty use.

"EVEREADY" No. 735 GENERAL PURPOSE BATTERY
Specially designed for general ignition, telephone, portable instruments, electronic equipment, etc.

The terms "Eveready", "Ignitor", "Nine Lives" with the Cat Symbol are registered trade-marks of Union Carbide and Carbon Corporation.

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N.Y.

Sales Offices: Atlanta, Chicago, Dallas, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco.

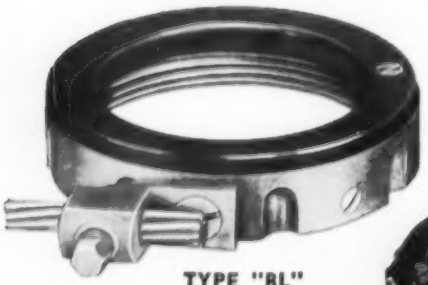
IN CANADA: Union Carbide Canada Limited, Toronto

CALL WESCO

THERE'S AN O.Z. BUSHING FOR EVERY JOB

TYPE "B"

Strongest insulating bushing available! Exclusive design permanently locks insulation into casting.



TYPE "BL"

Same as proven Type "B" with lug for quick, positive ground connections. Set screw in casting facilitates positioning.

Finest, high-strength, all-Bakelite insulating bushing. A top quality bushing—competitively priced!

TYPE "A"

All-Bakelite bushing with male thread for insulation of exposed cables passing through holes in metal boxes or troughs.

TYPE "BB"

Over 35 years of specialized experience in the design and manufacture of conduit fittings is behind the complete line of O.Z. insulating bushings. Whatever your insulating bushing problem, you can be sure there is an O.Z. design to fit your application perfectly. Buy O.Z. bushings from your local electrical distributor.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND ST. • BROOKLYN 2, N. Y.

CAST IRON BOXES • SOLDERLESS CONNECTORS
CABLE TERMINATORS • GROUNDING DEVICES
POWER CONNECTORS • CONDUIT FITTINGS

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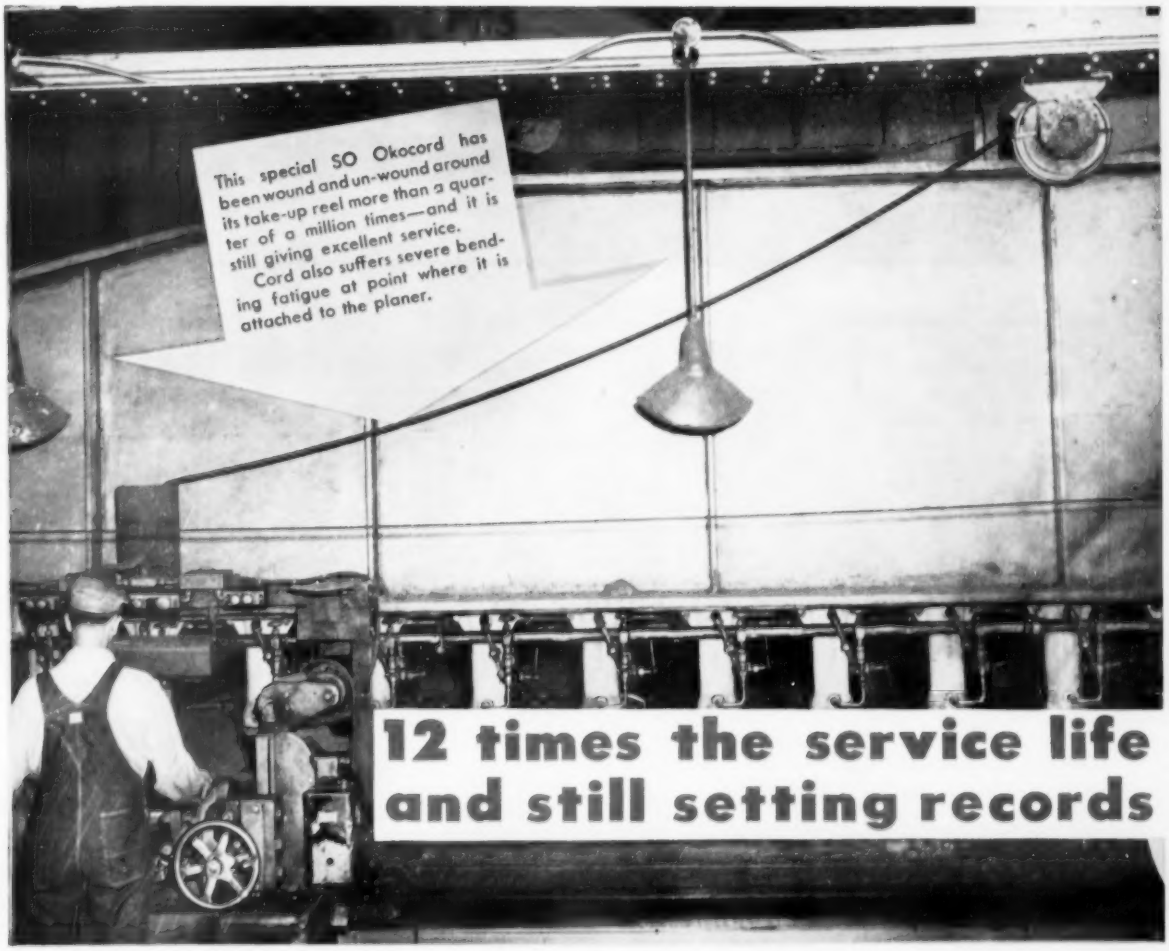
Representatives in all principal cities

FOR EVERYTHING ELECTRICAL.


This special SO Okocord has been wound and un-wound around its take-up reel more than a quarter of a million times—and it is still giving excellent service.
Cord also suffers severe bending fatigue at point where it is attached to the planer.

12 times the service life and still setting records

Until recently, a large steel fabricator was plagued with costly failures on control cable to the carriage of a 45′ planer. Ordinary Type SO cable was unable to withstand the great bending fatigue of constant winding and unwinding on a small take-up reel as the carriage moved back and forth an average of 45 times an hour for 90 hours per week. Cables had to be replaced about every six weeks.

Okonite engineers solved this problem with a special SO Okocord* construction. Combined with Okocord's normal high standards of quality, this construction completely eliminated the fabricator's problem. *The special SO Okocord has now been in service since April 1953—and is still giving excellent service.*

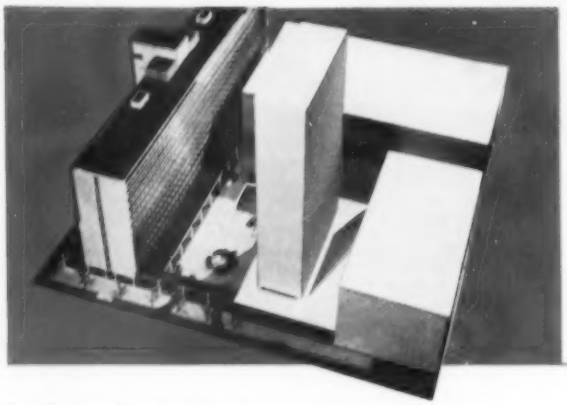
This successful installation is just one example of Okonite's ability to design Okocord constructions for difficult installations. Whenever you have problems involving a portable power supply, Okonite can help you eliminate costly down-time and power failures. Why not contact your Okonite representative today? Or write directly to The Okonite Company, Passaic, New Jersey.

***This product formerly carried the trade name Hazacord**

2646-A

where there's electrical power . . . there's **OKONITE CABLE**

CALL **WESCO**



"True offset, back- are a cinch with

Ben J. Massell Enterprises, Contractors
Peachtree-Baker Building, Atlanta, Georgia
Alexander & Rothchild, Architects
Whitehead Electric, Electrical Contractors

"INCH-MARKS" speed accurate cutting and bending. There's no need to struggle with a flat rule on a round tube. Each inch and foot is clearly marked along the entire length on ½", ¾", 1" and 1¼" sizes.

"INSIDE-KNURLING" another Republic exclusive on all popular sizes, takes much of the strain out of wire pulling. Tests show that the "ball-bearing" inside surface makes wire pulling up to 30% easier.

A GUIDE LINE runs the entire length of all popular-sized Republic E.M.T., makes it easy to keep bends in line. By aligning the "Inch-Marks" and Guide Line with calibrations on the Republic Bender, you get exactly the right degree of bend — with no costly "wows." ▶

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

FOR EVERYTHING ELECTRICAL.

to-back and saddle bends REPUBLIC 'Inch-Marked' E.M.T."

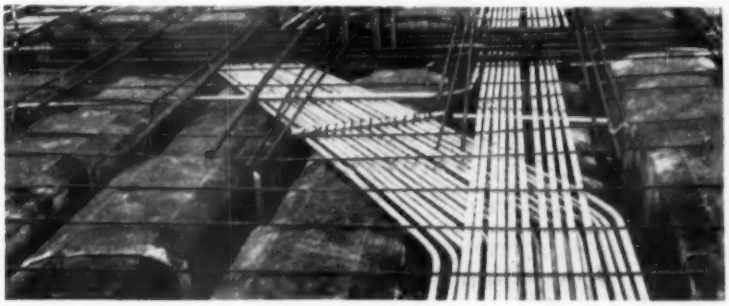
Electrical foreman points out ease of installation in big Atlanta concrete job— thanks to ELECTRUNITE'S exclusive features

"Both the 'Inch-Marked'® and 'Guide Lined' features that Republic offers on all popular sizes of ELECTRUNITE® E.M.T. are sure to simplify any installation — big or small," claims Hugh Brinkley, Electrical Foreman for the Whitehead Electric Co., of Atlanta, Georgia. Mr. Brinkley, an enthusiastic ELECTRUNITE E.M.T. user for more than 20 years, is currently supervising the installation of 150,000 feet of Republic E.M.T. in Atlanta's beautiful new Peachtree-Baker Office Building, scheduled for completion this fall.

He especially likes the smooth, accurate bends he gets every time — due in part to the "Inch-Marks," the Guide Lines and the uniform ductility in the Republic steel.

For those who haven't used Republic ELECTRUNITE E.M.T., he suggests you try it on your next job. To be certain you get Republic, just ask your electrical supplier for the E.M.T. that's "Inch-Marked" and "Guide Lined." Mail coupon for literature with complete specifications.

MR. BRINKLEY likes the way Republic "Inch-Marked" E.M.T. goes in on concrete pour jobs. Approved by the National Electrical Code for concealed, exposed and concrete installations, it also meets Underwriters' Laboratories standards and carries their inspection seal.



SYMMETRICAL BENDS in multiple runs are easy with Republic E.M.T. And there are no threads to cut, no long lines to turn. Every coupling acts as a union.

REPUBLIC STEEL CORPORATION
Dept. C-1720, Steel and Tubes Division
212 East 131st Street, Cleveland 8, Ohio

Please send me:
☐ Complete information on Republic ELECTRUNITE E.M.T.
☐ Bending instructions on handy wall chart.

Name _____ Title _____

Company _____

Address _____

City _____ Zone ____ State _____

STEEL

and Steel Products

CALL **WESCO**

OEM COMPLETE LINE

OF POLE-LINE MATERIALS IN STOCK FOR YOU AT **WESCO!**

For years you have depended on WESCO
for fast service on Oliver Pole-line Materials.
We are proud of the job they have done for both
you and us.
Now, a merger which joined Oliver and Electrical Manufacturing Co.
places an even broader line of pole-line distribution materials
right on your doorstep . . . today's products plus new
ideas and products for tomorrow already being developed
in the OEM research department . . . through the
nation-wide facilities of WESCO.

81

OLIVER ELECTRICAL MANUFACTURING CO.

BATTLE CREEK, MICHIGAN • PITTSBURGH, PENNSYLVANIA

FOR EVERYTHING ELECTRICAL.

Here's the New ECONOMY Lug with QUALITY improvements ★

SHOWN ACTUAL SIZE—

The 7 sizes of PennLugs, Type PNL:

PNL 1000; 500 to 1000 MCM
PNL 500; 4/0 str to 500 MCM
PNL 300; 1/0 str to 300 MCM
PNL 4/0; 1/0 str to 4/0 str
PNL 1/0; 4 sol to 1/0 str
PNL 4; 14 sol to 4 str
PNL 8; 14 sol to 8 str

On all sizes, tongue is NEMA standard.

Insulation butts flush, full circle — the PennLug's circular boss gives a snug fit and easier taping.

Annular serrations for higher conductivity and better resistance to horizontal pull — cable is snubbed behind the ridges.

More contact area with the conductor (up to 11% more) than conical, cylindrical or hexagonal bodies.

UL approved in all sizes.

No extra cost for these improvements — prices as attractive as the lugs.

Write for samples of the sizes you are using.

PENN-UNION PENNLUGS

PENN-UNION ELECTRIC CORPORATION • ERIE, PA.

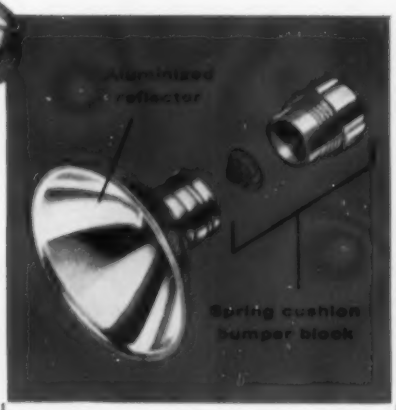
. . . CALL WESCO

NEW heavy-duty industrial RAY-O-VAC flashlight!

"WORKMAN"
No. N22—2-cell
No. N32—3-cell

Shortproof industrial flashlight

NEW rugged case . . . new advanced design . . . tops for industrial use



Aluminized reflector surface extra-protected by heavy lacquer. Spring-cushioned bumper block assures positive battery contact, protects bulb from shock.

New exclusive easily replaceable switch ends greatest cause of flashlights being discarded. All parts replaceable over and over . . . life extended indefinitely.

Removable end cap makes battery change fast and easy. Molded clip in base holds spare lamp.

Tough ring hanger is molded part of end cap. When not in use, hanger clips into lower end of cap.

New Ray-O-Vac Leak Proof Industrial Batteries. Sealed-in-steel. Longer usable bright light. Guaranteed against corrosion.

New improved lantern battery specially designed for rough, tough yard use. More than meets specifications of railroads and U. S. Bureau of Standards. Heavy coil spring terminals. Label discourages pilferage.

Here is the really better industrial heavy-duty flashlight you've been looking for! Every detail has been designed and constructed for toughest industrial use. The "Workman's" new case is featherlight, yet far tougher than steel. Offers a new high in resistance to breakage, temperatures, chemicals. No exposed metal parts to create flashlight shorts and reduce the life of batteries. Every part replaceable for lifetime wear in any service. Lacquered aluminized reflector gives perfect spot. Order now for prompt delivery from your nearby Wesco branch.

RAY-O-VAC COMPANY
MADISON 10, WISCONSIN

Division Offices: 212 East Washington Ave., Madison 10, Wisconsin. 1388 Madison Avenue, Memphis 4, Tennessee. 461 Market Street, San Francisco 5, California. 1775 Broadway, New York 19, New York. Ray-O-Vac Canada, Ltd., Winnipeg.

PROGRESS THROUGH PRODUCTS THAT SERVE
RAY-O-VAC
1906 1956
50th ANNIVERSARY

FOR EVERYTHING ELECTRICAL . . .

One of the large wrapping machines which applies varnished cambric tapes to various types of Rockbestos A.V.C. cables. Rotating heads apply the specially selected tapes to provide specified mil wall thicknesses, desired lap and length of lay required by the type of cable in process.
Pictured is the application of fluffy asbestos prior to the impregnating and compressing process.
Impregnated asbestos compressed and felted to a smooth homogeneous wall ensuring long cable life.

Quality Varnished Cambric Tapes

+

felted asbestos walls impregnated with selected compounds add up to long life Rockbestos A.V.C. (N.E.C. Type AVA)

Made to Rockbestos' exacting specifications which incorporate standards beyond those called for by industry, Rockbestos varnished cambric tapes assure you of these plus values:

- ★ **A special surface treatment which insures that the tape will wrap properly, providing uniform dielectric strength and good bending characteristics in the completed cable.**
- ★ **Special surface hardness tests which mean varnish film that will not become damaged in processing or handling.**
- ★ **Rigid tape thickness requirements which give you uniformity of cable diameters.**
- ★ **Add to this thirty years of know-how in the application of VC tapes for high temperature application on Rockbestos A.V.C. cables and you have A.V.C. cable that insures trouble-free operation and long life.**

In the Rockbestos A.V.C. construction dense, felted asbestos walls, impregnated with selected compounds, seal the quality VC tapes away from air and moisture . . . give added strength against damage and flexing.

The result . . . you get long life and dependable service under every type of operating condition . . . in temperatures up to 230°F.

Complete construction and test specifications of Rockbestos A.V.C. are in the new booklet "Specifications RSS-88." Write today for your Free copy.

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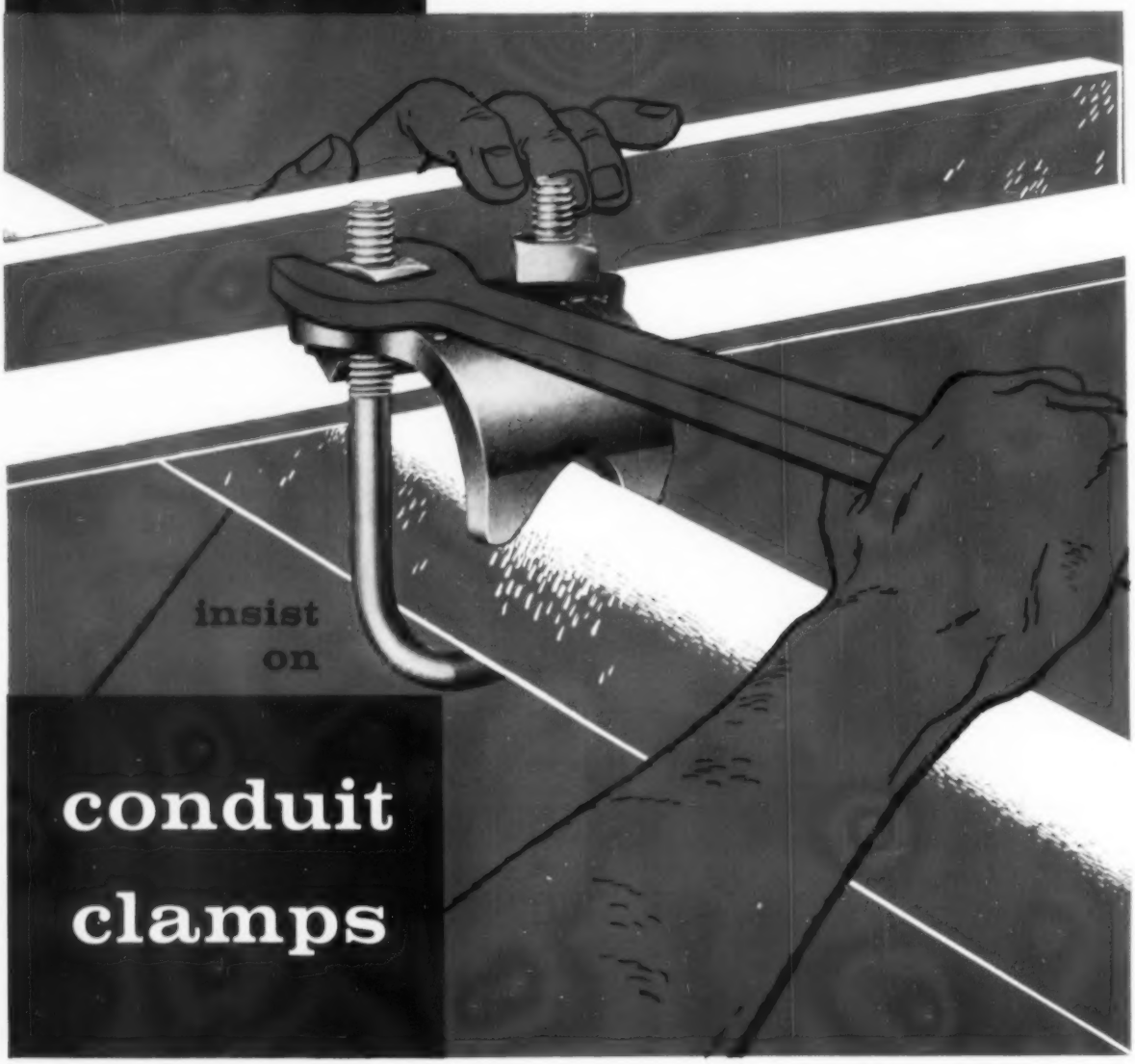
STOCKED COAST TO COAST
Standard Rockbestos A.V.C. construction (N.E.C. types AVA, AVB, etc.) are available for immediate shipment. Call or write nearest branch office.

. . . CALL **WESCO**

...better because they're electro-galvanized at no extra cost.

...stronger because of a case-hardened steel insert that "bites" into the beam for maximum security.

...handier because they're packed in clearly labeled cardboard cartons.



by **STEEL CITY** ELECTRIC COMPANY
Pittsburgh 33, Pa.

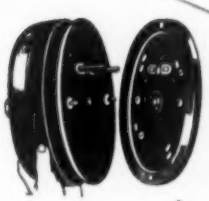
FOR EVERYTHING ELECTRICAL

AUDIBLE SIGNALS THAT ARE EASIER TO INSTALL AND INTERCHANGE

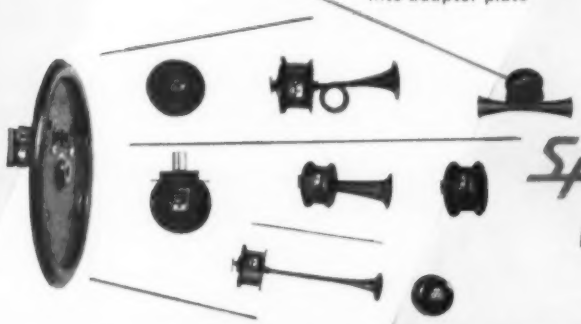
Follow these Simple Steps for Safer, Faster, Easier, Installation

1. Wire to back of dead front adapter plate

2. Secure adapter plate to box or fitting



3. Plug any of 12 Uni-pact signals into adapter plate



12 interchangeable sound instruments assure correct sound level for every situation. When changed noise levels demand a new type of signal, there is an interchangeable bell, buzzer, horn or chime to fit your requirements—and they're as easy to install as plugging in any appliance.

Electrically dead front adapter plate and elimination of exposed terminals assure safety.

Sperti Faraday Inc.

Engineers in sound and sight since 1875

ADRIAN, MICH.

Sperti Faraday of Canada, Ltd., Montreal, Quebec

CALL WESCO

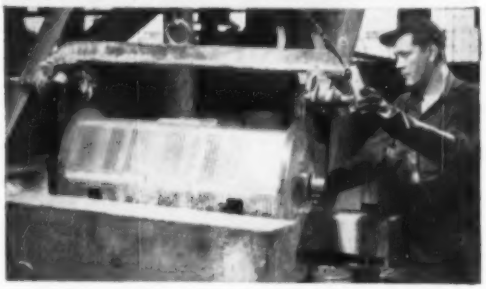
▲ Bill Johnson (right), Superintendent of Spang's Coupling Department, points out top-quality electroplated finish and uniform threads on Spang HD Coupling to Spang customer and Spang's Chief Inspector, Bill Mickley.

Nobody Makes Couplings Better than SPANG®

Check these 6 top-quality features that bring you easier, better conduit installations

1. **Top-grade steel** . . . SPANG Couplings are made of top-grade, free-machining steel which provides easy threading for best results during coupling manufacturing.
2. **Quality-controlled processing** . . . couplings receive the same care in manufacturing as SPANG HD Galvanized Conduit. Thorough testing and inspection, too!
3. **Galvanized finish** . . . hot dipped in lengths before cutting and threading . . . another SPANG extra.
4. **Electroplated** . . . inside and outside after threading to protect interior threads and bearing faces and give exterior surfaces double protection.
5. **Clean threads** . . . perfect every time! No burrs, no binding, easy to work with!
6. **No galvanic action** . . . electroplated and galvanized finish prevents metal-to-metal contact between couplings and conduit . . . avoids any galvanic action.

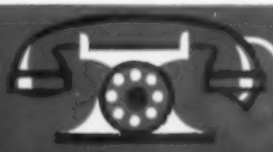
▼ Mark Glusic removes a basket of couplings from the electroplating tank. This finishing process protects threads, gives extra protection to exterior surfaces.



If it's *quality* you want, SPANG Couplings have it! Your local WESCO Distributor carries the full range of coupling sizes along with the rest of the complete SPANG Conduit line. Make your next order SPANG!

SPANG® CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
TWO GATEWAY CENTER, PITTSBURGH, PA.
District Offices and Sales Representatives in Principal Cities



FOR EVERYTHING ELECTRICAL.

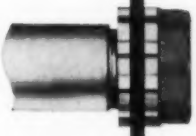
INSULATED CONNECTORS

THE NEW CONCEPT IN FITTINGS THAT REDUCES WIRE PULLING EFFORT UP TO 50%

Insulating Bushing

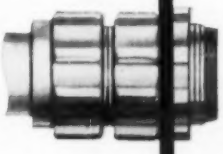
Insulated Metallic Bushing*

Insulated Chase Nipple



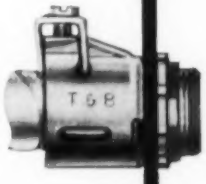
STANDARD RIGID CONDUIT

Insulated EMT Connector



ELECTRICAL METALLIC TUBING

Insulated Tite-Bite Connector — straight



FLEXIBLE CONDUIT OR ARMORED CABLE

Insulated Tite-Bite Connector — 90°

*available soon

Look for the bright blue insulation

ANOTHER NEW T&B ENGINEERED EXCLUSIVE —
The First Line of Self-Insulated Raceway Fittings! Just look at the many benefits you get with these new "insulined" fittings.

They are the *EASIEST* to Install

Factory-assembled, the Insuliner is a permanent part of the fitting — it can never come loose or pull out. The slippery insulined throat cuts pulling effort by as much as 50%.

They make the *SAFEST* Installation

Because of the nationwide accent on safety, the trend is toward insulated fittings in all locations. Insulated bushings are standard fittings today. Extremely tough they are unaffected by common acids, solvents, moisture or fumes.

They make the *MOST ECONOMICAL* Installation

A one-piece fitting makes installation fast and easy for maximum on-the-job savings. There is no need to add a separate insulating bushing.

They give the Installation a *QUALITY LOOK*

Strong, longer bodies and heavy lock nuts . . . 100% visibility . . . accurate threading . . . all of the features you've come to expect in a T&B engineered fitting.

Write for free samples and technical data or contact your nearby T&B Distributor.

LOOK FOR THIS SIGN —

AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T&B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T5B

UL

All T&B insuline fittings bear Underwriters Laboratories Approval

THE THOMAS & BETTS CO.

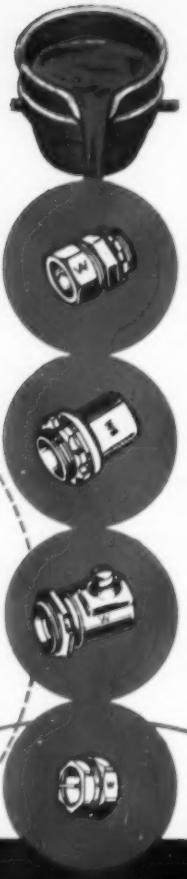
INCORPORATED

34 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF QUALITY ELECTRICAL FITTINGS SINCE 1898

CALL WESCO



E.M.T. FITTINGS
COMPRESSION
SET SCREW
BM INDENTER

● This comprehensive line of thin-wall (EMT) conduit fittings is available in a wide variety of types and sizes. When you specify WAGNER you know that you are getting fittings of uniform highest quality. Each is tough, precision threaded, perfectly finished, and easy to work with.

WAGNER
GIVES YOU EVERY
Desirable
WORKING FEATURE

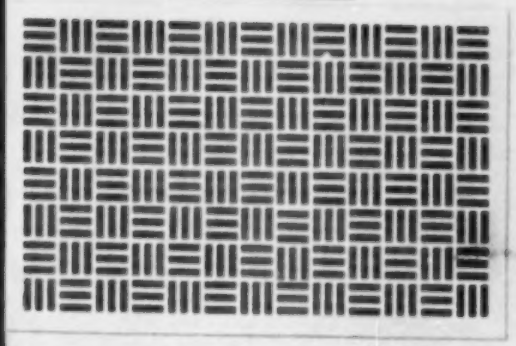
WAGNER MALLEABLE PRODUCTS CO.

General Sales Office
- 222 W. Adams St., Chicago 6, Ill.
- *Foundry and Plant:* Decatur 60, Ill.

The Mark of Quality

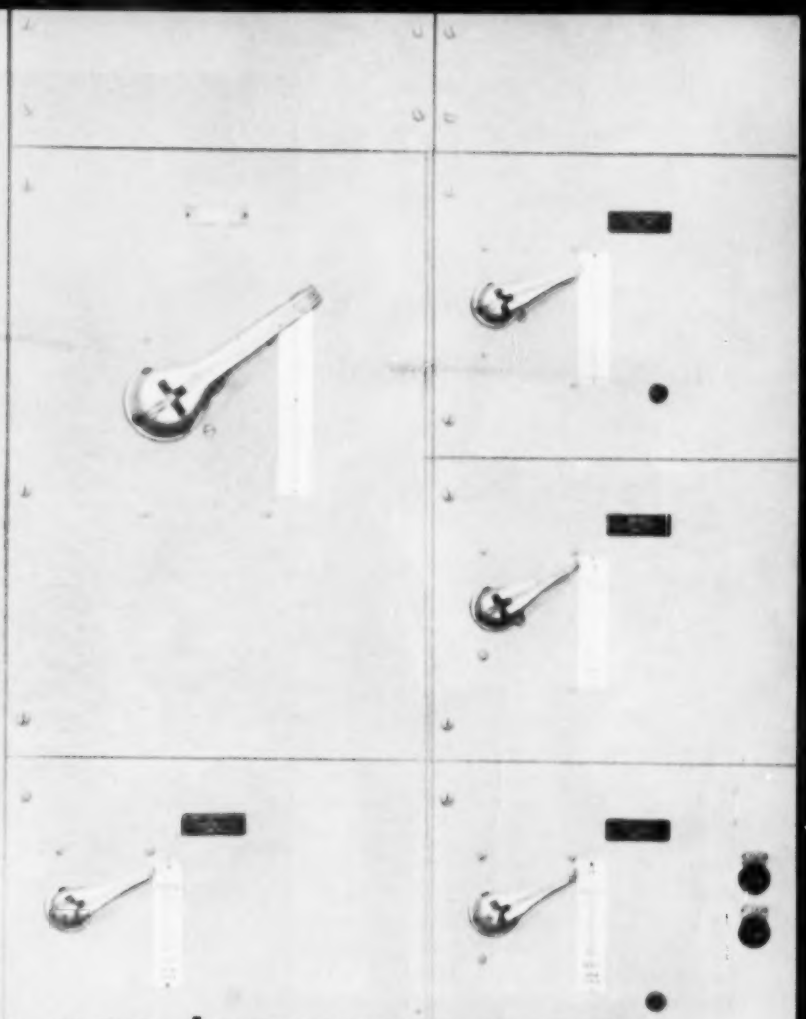
FOR EVERYTHING ELECTRICAL

LGB-24

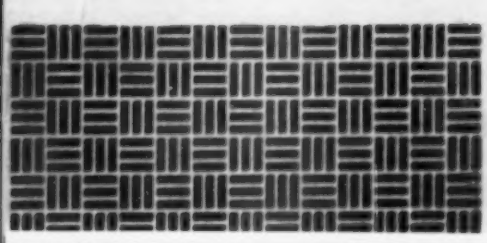


LTG. TRANSFORMER
150 KVA 3 PH.
480/120-208 V.

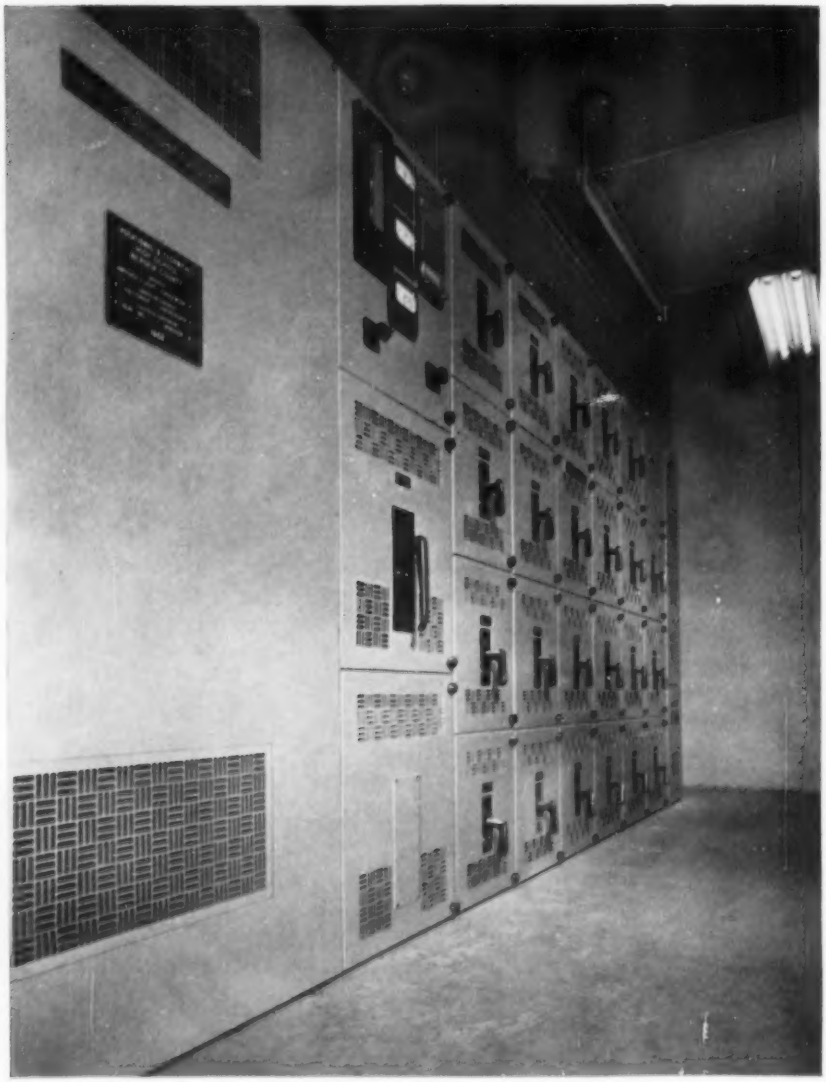
•WESTINGHOUSE•



How you can increase your production efficiency



CALL **WESCO**



Slice Installation Cost With Westinghouse Pre-assembled Switchgear

It's axiomatic: the lower your costs the higher your profits. With heavy-duty electrical equipment, high installation cost sometimes knocks profits out of the picture. Not so with Westinghouse switchgear.

Westinghouse pre-assembles units in the factory according to your specifications. You get custom-built voltage protection at rates comparable to mass-produced standard equipment.

The bonus with Westinghouse switchgear is precision engineering of basic design plus quality control throughout manufacturing and assembly.

You get many other benefits: built-in circuit breaker protection, assurance of minimum voltage variation, and many others. See your Westinghouse distributor for details, because you can be sure if it's Westinghouse.

DP-5027-A

FOR EVERYTHING ELECTRICAL.

Westinghouse Panelboards Keep Your Circuits 100% Flexible

You can convert or expand or change over distribution panelboard branch circuit requirements without unnecessary expense—if those panelboards are Westinghouse. The only tool needed is a screw driver.

Quick production changes require the flexibility in distribution equipment that Westinghouse CDP panelboards give. Quick changes to the correct protective device for equipment mean less down time and a resulting higher production output. More profits.

In CDP panelboard (shown), this conversion can be made easily because Westinghouse provides pre-drilled and pre-tapped busbars, back pan, and other standardized parts. One or more breakers can be replaced with larger or smaller ones to match changing circuit-protection requirements.

There is a Westinghouse panelboard to fit *your* requirements (see below). DP-5027-B

NPLB Panelboard—factory-assembled lighting panelboard.

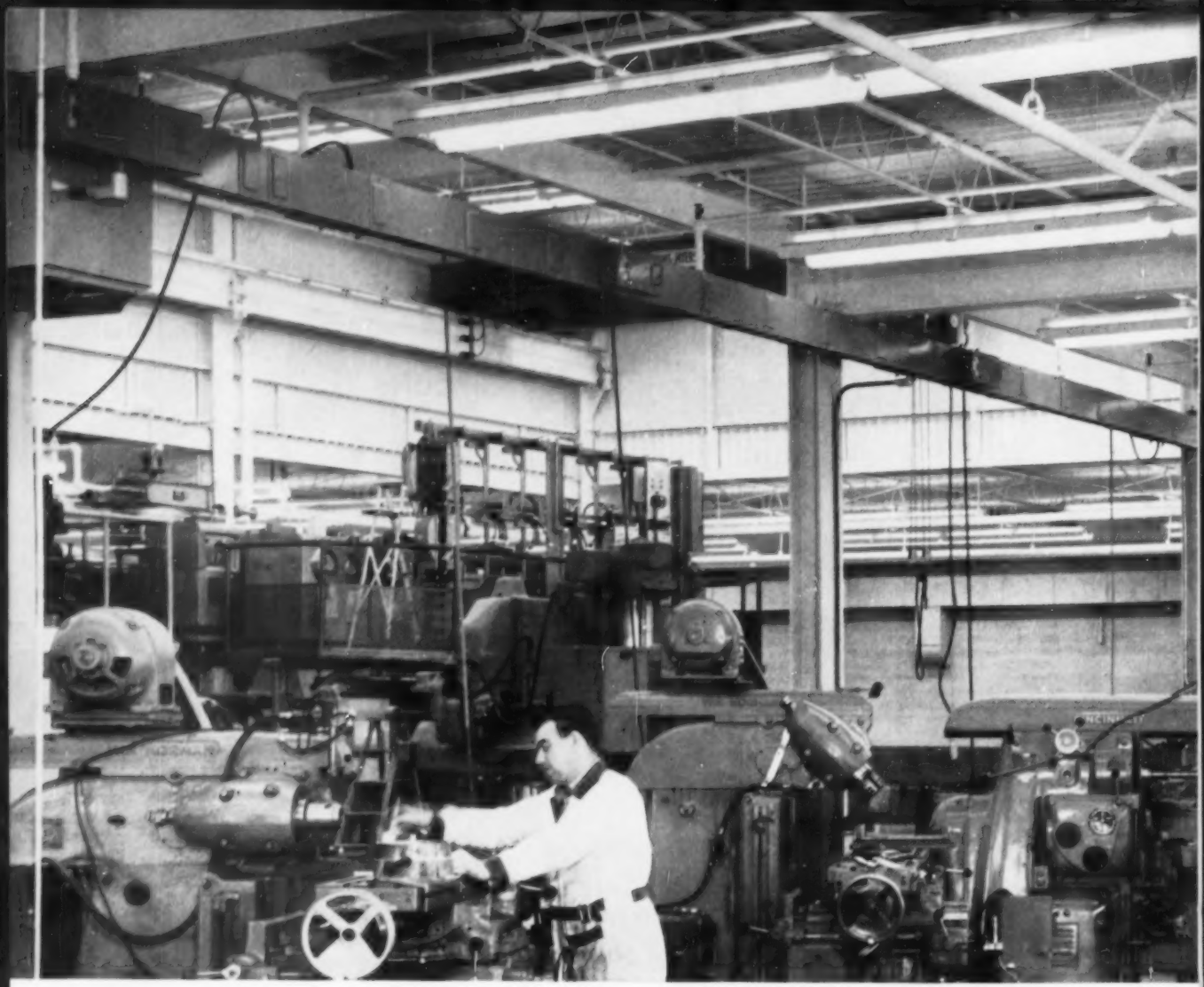
Add-A-Cirkit Panelboard—breakers for new circuits easily added.

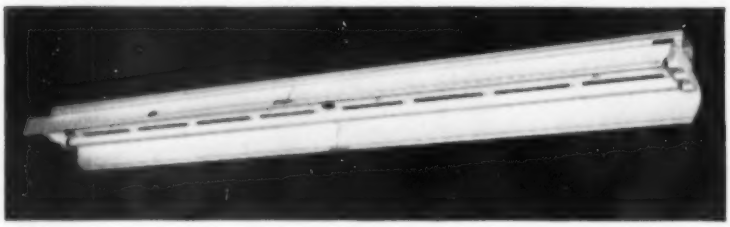
CDP Panelboard—permits maximum rearrangement flexibility.

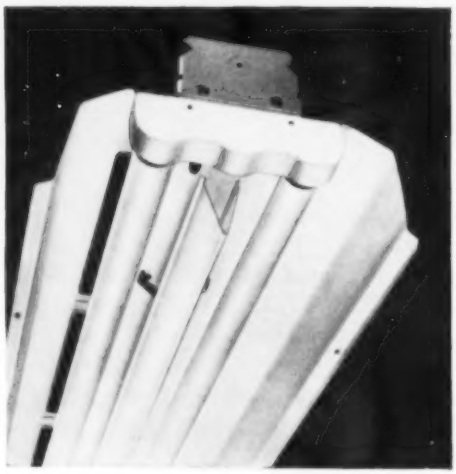
WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

CALL **WESCO**







RLM fluorescents mean better efficiency in areas where effortless, accurate vision is essential. Fixtures stay clean longer . . . operate cooler due to air circulating through reflector apertures. And maintenance is minimized.

RLM's one-piece channel is lightweight, easy to handle. Easy-to-grip wing locks hold reflector firmly in place. No loose parts can be lost, no tools are needed for installing or reflector removal. Starter sockets are positively identified.

WATCH WESTINGHOUSE

FOR EVERYTHING ELECTRICAL.

RLM Fluorescents With 20% Up-Light Mean Faster, More Comfortable Vision

Over one-fifth of the light from Westinghouse RLM fluorescents is reflected upward. It literally bounces off the ceiling down to production areas adding extra—but now diffused—light. With higher illumination levels and better quality lighting, you'll notice an increase in acceptable production output.

With this lighting properly laid out to recommended foot-candle levels, production can change in type and scope, employee number can grow, and new machines can be added without making it necessary for you to add any more light to insure proper working conditions.

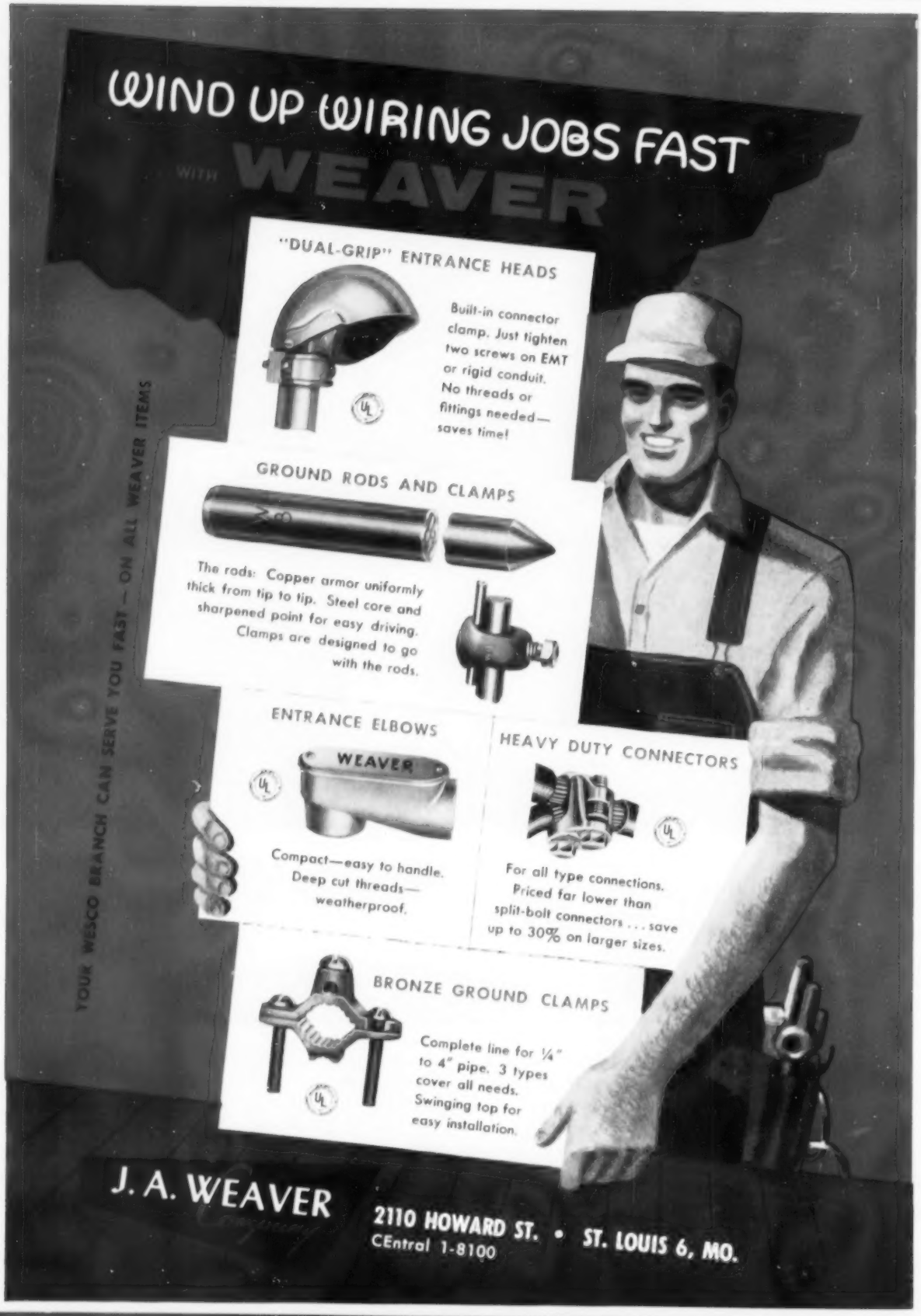
Westinghouse uses heavy-duty, steel-enclosed lamp holders for RLM's to make lamp replacement as simple as possible for you and eliminate the expense of breakage. Lightweight, completely wired channels, which permit fast installation, help lower initial costs.

Why not call the Westinghouse man listed in your area. He has more facts about lighting which are sure to help you. And you can be sure if it's Westinghouse. DP-5027-C

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU**!*

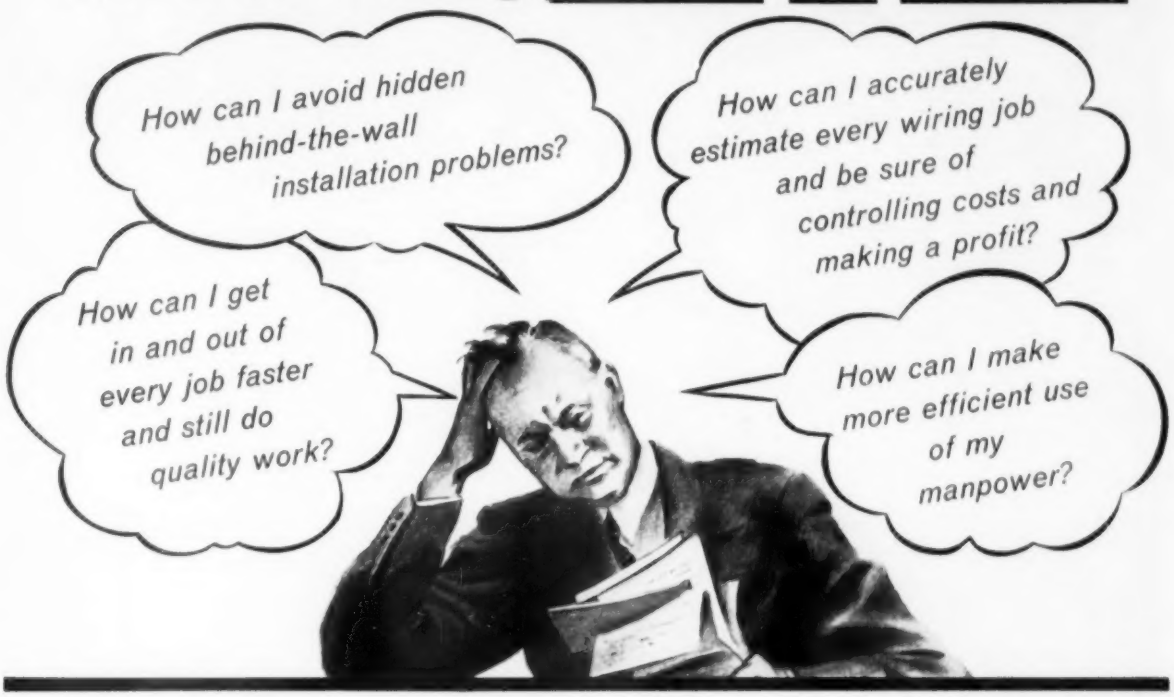
CALL **WESCO**

WIND UP WIRING JOBS FAST WITH WEAVER


"DUAL-GRIP" ENTRANCE HEADS
Built-in connector clamp. Just tighten two screws on EMT or rigid conduit. No threads or fittings needed—saves time!
GROUND RODS AND CLAMPS
The rods: Copper armor uniformly thick from tip to tip. Steel core and sharpened point for easy driving. Clamps are designed to go with the rods.
ENTRANCE ELBOWS
WEAVER
Compact—easy to handle. Deep cut threads—weatherproof.
HEAVY DUTY CONNECTORS
For all type connections. Priced far lower than split-bolt connectors . . . save up to 30% on larger sizes.
BRONZE GROUND CLAMPS
Complete line for ¼" to 4" pipe. 3 types cover all needs. Swinging top for easy installation.
YOUR WESCO BRANCH CAN SERVE YOU FAST — ON ALL WEAVER ITEMS
J. A. WEAVER
2110 HOWARD ST. • ST. LOUIS 6, MO.
CEntral 1-8100

FOR EVERYTHING ELECTRICAL . . .

Turn these rewiring Problems into *PROFITS!*


How can I avoid hidden behind-the-wall installation problems?
How can I accurately estimate every wiring job and be sure of controlling costs and making a profit?
How can I get in and out of every job faster and still do quality work?
How can I make more efficient use of my manpower?

Plan the work and work the plan...*it's easy*

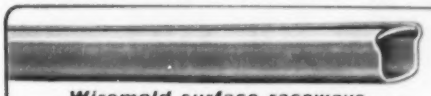
with WIREMOLD and PLUGMOLD

the modern surface raceway systems for new wiring and rewiring!

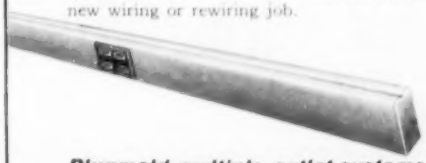
Take advantage of the big rewiring business in your area!

• You can take advantage of the big rewiring market by using Wiremold and Plugmold . . . the modern way to wire and rewire. • You can pre-plan every wiring job and follow the plan more easily with pre-engineered Wiremold and Plugmold. • You can do more jobs, you can control installation costs and make more profit on every job with Wiremold and Plugmold. • You can build and keep more customer satisfaction with Wiremold and Plugmold. • Wiremold and Plugmold meet all code requirements.

(Write to Department E-11 for information)



Wiremold surface raceways . . . Safest way to carry electrical power anywhere in any building. One-piece construction makes installation easy . . . requires no special tools or gadgets. Four sizes fit every new wiring or rewiring job.



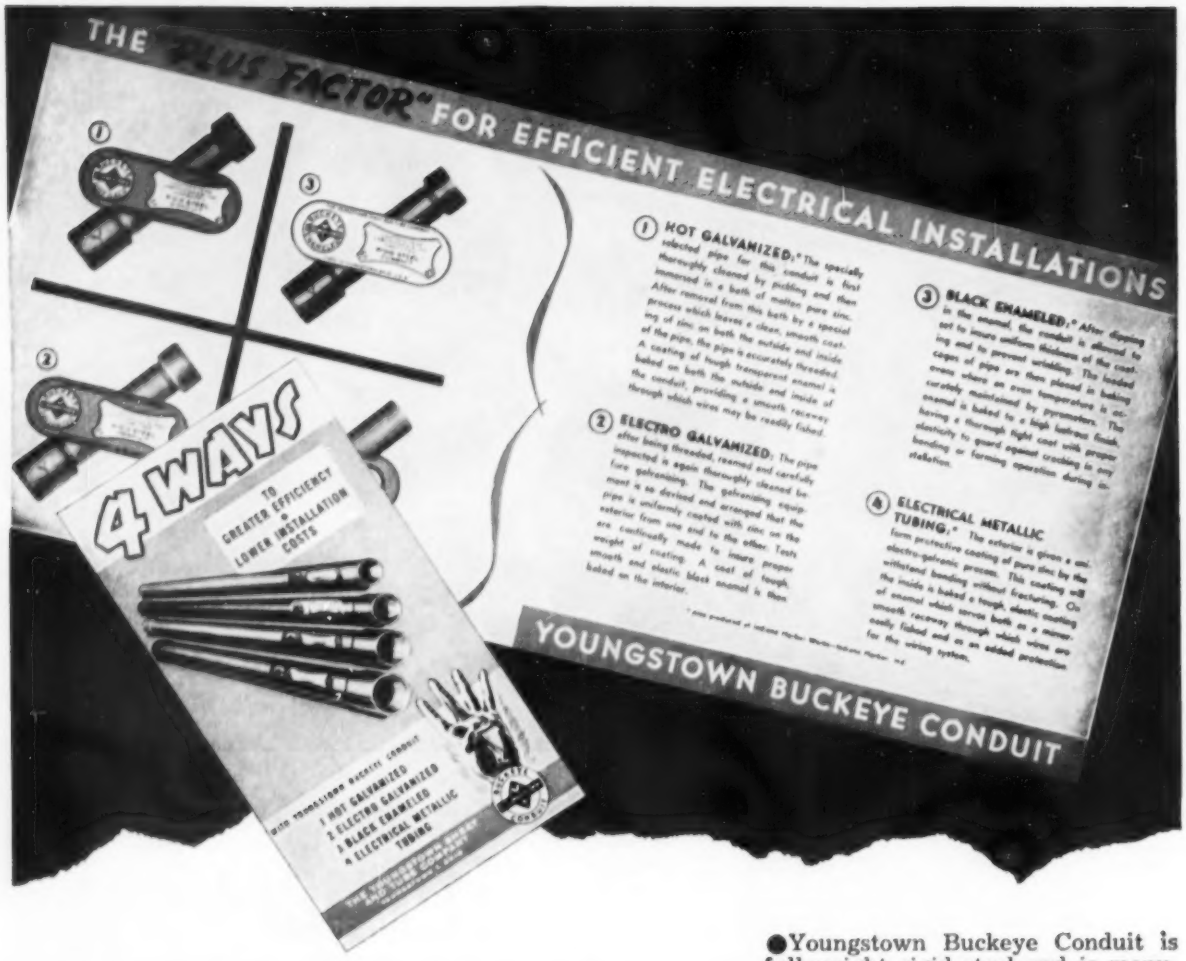
Plugmold multiple outlet systems . . . The *modern way* to provide continuous electrical outlets for homes, factories, stores, offices, any building new or old. Five types of Plugmold are adaptable to *every* outlet need.

Pancake overfloor raceways . . . Carry power or telephone lines overfloor to the point of use . . . *safely!* Pancake answers the growing need for more flexible wiring layouts . . . two interconnecting sizes meet all requirements.

THE WIREMOLD COMPANY

HARTFORD 10, CONNECTICUT

CALL WESCO


THE "PLUS FACTOR" FOR EFFICIENT ELECTRICAL INSTALLATIONS
4 WAYS
TO GREATER EFFICIENCY & LOWER INSTALLATION COSTS
1 HOT GALVANIZED
2 ELECTRO GALVANIZED
3 BLACK ENAMELED
4 ELECTRICAL METALLIC TUBING
1 HOT GALVANIZED: The specially selected pipe for this conduit is first thoroughly cleaned by pickling and then immersed in a bath of molten pure zinc. After removal from this bath by a special process which leaves a clean, smooth coating of zinc on both the outside and inside of the pipe, the pipe is accurately threaded. A coating of tough transparent enamel is baked on both the outside and inside of the conduit, providing a smooth raceway through which wires may be readily fished.
2 ELECTRO GALVANIZED: The pipe after being threaded, reamed and carefully inspected is again thoroughly cleaned before galvanizing. The galvanizing equipment is so devised and arranged that the pipe is uniformly coated with zinc on the exterior from one end to the other. Tests are continually made to insure proper weight of coating. A coat of tough, smooth and elastic black enamel is then baked on the interior.
3 BLACK ENAMELED: After dipping in the enamel, the conduit is allowed to set to insure uniform thickness of the coating and to prevent wrinkling. The loaded cages of pipe are then placed in baking ovens where an even temperature is accurately maintained by pyrometers. The enamel is baked to a high lustrous finish, having a thorough tight coat with proper elasticity to guard against cracking in any bending or forming operation during installation.
4 ELECTRICAL METALLIC TUBING: The exterior is given a uniform protective coating of pure zinc by the electro-galvanic process. This coating will withstand bending without fracturing. On the inside is baked a tough, elastic insulating of enamel which serves both as a moisture-proof raceway through which wires are easily fished and as an added protection for the wiring system.
YOUNGSTOWN BUCKEYE CONDUIT

Write for this new folder about first aid for wiring protection

Youngstown

BUCKEYE CONDUIT

●Youngstown Buckeye Conduit is full-weight rigid steel and is manufactured as Hot Galvanized, Electro-Galvanized and Black Enameled. It is available for immediate delivery in sizes from half inch up to six inches. We can also furnish Electrical Metallic Tubing in sizes from half inch up to two inches.

"4 Ways to Greater Efficiency, Lower Installation Costs" is a new folder giving a full description of each type, with complete information as to wall thicknesses, fittings, etc. Copies are available at no charge to guide you and your customers in the selection of steel conduit. Write for as many as you can use.

Rigid steel conduit is the SAFE raceway approved by the National Electrical Code for all hazardous locations. To be ENTIRELY SAFE use the best, use Youngstown Buckeye Conduit, your first aid for wiring protection.

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: Youngstown, Ohio - District Sales Offices in Principal Cities

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES

FOR EVERYTHING ELECTRICAL.

More and More Woodhead Safety on Tap...

SAFETY FIRST

with the NEW

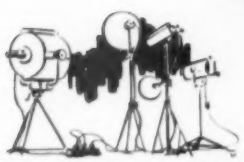
MULTI-TAP

OUTLET BOX

Available with

VARIOUS TYPE RECEPTACLES

"K" PARALLEL | "T" TANDEM | "Y" CROWFOOT | "U" "U" BLADE | "X" TURNEX



MOVIE AND TELEVISION STUDIOS

ASSEMBLY LINES

CONSTRUCTION INDUSTRY

FOR AIRCRAFT

Again Woodhead is FIRST...

with an ALL NEōTEX *triple outlet box!*

The new "MULTI-TAP" outlet box is the answer wherever industry demands the BEST...for construction work of all kinds, for aircraft production and service, for motion picture and photography studios and for industrial assembly lines everywhere.

BUILT for SAFETY and SERVICE...full NEōTEX box construction is impervious to oils, greases and most chemicals...will not scratch surfaces over which it is pulled.

RUGGEDLY BUILT FOR YEARS OF DEPENDABLE SERVICE!

Simple, durable interior construction has buss-bars running across contacts...easy to wire. Plug caps insert into box cover lip that prevents shorting blades.

AVAILABLE WITH ALL CORD LENGTHS

New "MULTI-TAP" outlet box available complete with cord and plug cap...prices furnished upon request...BE SURE TO SPECIFY size of cord, length of cord and type of plug cap and receptacles needed.

NEW...in the Daniel Woodhead Line!

DANIEL WOODHEAD CO. • 15 N. JEFFERSON ST., CHICAGO 6, ILLINOIS

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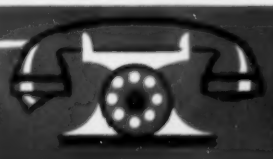

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It's a fact that WESCO is as near as your phone. When you call WESCO, a lot goes on to make sure you get "same-day delivery" when humanly possible. This remarkable service stems from the fact that WESCO stocks its many nationally known electrical products *locally*.

Speedy Service

When your call comes in, this one dependable source can deliver any of over 13,000 electrical items within 24 hours. Now, there is no need to load up on normal electrical maintenance and repair items.

118 Branches

In 118 branches, our policy is delivery where you want it, when you want it. And that's not all! We can help with trained specialists on tough jobs that are looking a deadline in the eye.

Tear out this page and keep the number of your nearest WESCO branch handy. Or just look in the Classified Directory under "Electrical Supplies, Wholesale and Manufacturer".

WESTINGHOUSE ELECTRIC SUPPLY COMPANY

For Everything Electrical . . . Dial WESCO

Practical Methods

Mercury Unit with Uplight Improves Lighting Quality

LIGHTING

The new lighting system in the Vancouver Avenue cranebay of the American Metal Products Company in Detroit sets a new high in quality for industrial plant lighting. High-bay aluminum reflectors of a new type are used, and provide an average illumination level of 33 footcandles throughout the 27,600-sq-ft area with a minimum of brightness contrast. This makes for a practically ideal visual environment, and for maximum ease in seeing.

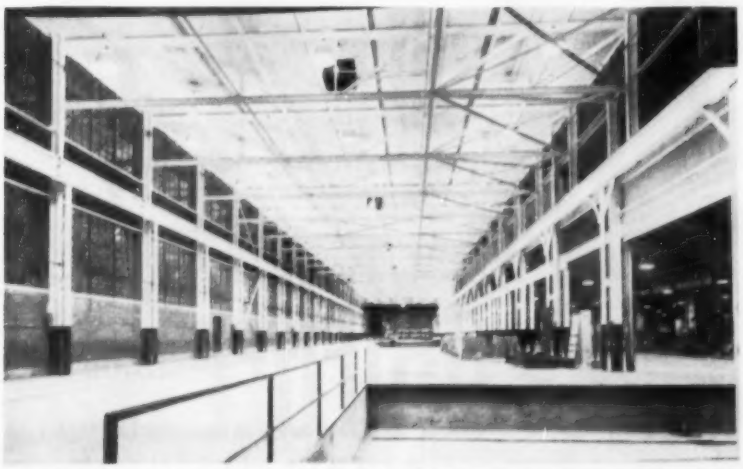
The cranebay is 460 feet long, and 60 feet wide. The reflectors are installed 27-ft 10-in above the floor, on 20-ft by 20-ft spacings, with a total of 69 reflectors being used.

The new type reflectors are Abolite Type HMFAU-2400 aluminum units, 24 in. in diameter, with provision for an 18% upward component of light which lights the overhead ceiling softly and reduces the brightness contrast between the lighted reflectors and the ceiling to a comfortable minimum.

Each reflector uses a Type H400 RC-1 General Electric Company vapor lamp, of the color improved type, except that one reflector in every fourth section (six units total) is an Abolite Type GBF Protecto- Shield, equipped with a 750-watt R52 incandescent reflector lamp, and connected to a separate circuit. These six incandescent units are used for night lighting, and for emergency lighting during restarting cycle when power outage temporarily disrupts the mercury vapor lighting.

The new reflector, recently announced as a new development in lighting by the Illuminating Engineering Society in its annual Lighting Progress Report, brings to industrial high bay lighting the same uplight feature that has been available for some three or four years for low bay industrial lighting, through the use of open-top type fluorescent industrial reflectors. While several installations of this new unit have already been made, the American Metal Products Company job is said to be one of the best high bay lighting systems ever installed.

This installation was installed by the Hall Engineering Company, electrical contractors. The equipment, made by the Abolite Lighting Division of the Jones Metal Products Co., was supplied by the General Electric Supply Co., Detroit. The Austin Company were the engineers and general contractor. Cooperating in the selection and design of this new lighting system were Ted Homer, G. E. lamp engineer, and Duncan Preston, of the Detroit Edison Company.



UPLIGHT from new mercury reflector unit lights ceiling softly, provides good visual environment in this high bay cranebay area at American Metal Products Co. plant in Detroit. Note difference in appearance of cranebay area, with lighted ceiling, and adjoining area (right) using old style closed top industrial reflectors.

Diffused Lighting Provides 90 Footcandles for Panel

LIGHTING

In research laboratories, accuracy in reading meters or in noting system characteristics must be of a high order, for the dependability of an experiment or tests can only be as reliable as the greatest error. This is particularly important when test data is constantly and rapidly changing, such as at the Lewis Flight Propulsion laboratory in Cleveland, Ohio, where research involves speed ranges many times the speed of sound, temperature ranges of thousands of degrees, and altitude ranges of ten miles or more.

For that reason, operators' panels (of which there are several dozen) utilize quality-quantity lighting, different colors for lamps and diagrams related to different types of information, readily-readable dials and meters, plus shielding, diffusing and circuiting variations best suited to the seeing or operations task at hand.

For example, the panel here illustrated (control center for dispatching refrigerated and combustion air and altitude exhaust) utilizes a mimic bus diagram, colored indicating lights and several banks of meters to indicate valve positions, temperatures of bearings and water, plus operating pressures of various machines in this area. General lighting on the 10-ft-high board is provided by Daybrite 2-lamp 40-watt instant-start fixtures which are mounted continuously across the top of the panel, 18 in. from the vertical face. Reflectors are asymmetrically designed white porcelain units, directing light inwards and downwards to blanket the face of the board, and Skytex glass is positioned beneath the fluorescent

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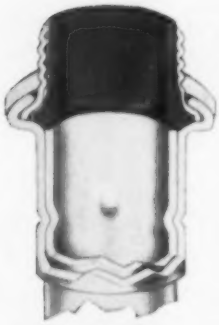
Connector



Red Throat
Cross section

Briegel, the Original Indenter Fittings are neater in appearance, easier and faster to use. Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job.

All B-M Indenter Fittings are U.L. Approved as concrete-tight and for general use (File Card E10863). Also comply With Federal Specifications W-F-406.

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B-M COMPRESSION TYPE FITTINGS
FOR E.M.T. Rain-tight

SIZES FROM ½" to 2"

SIZES FROM ½" to 2"

SIZES ½" ¾" 1"

SIZES ½" ¾" 1" 1¼"

SIZE ½"

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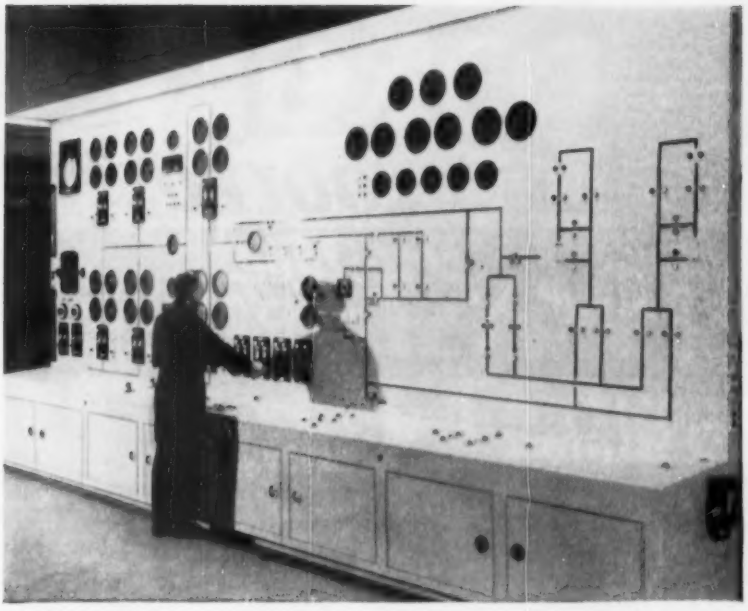

CONTROL CENTER operations panel is top-lighted by double row of fluorescent lamps in asymmetric reflector located 18 in. in front of board's vertical face. Skytex glass beneath lamps diffuses light, which places 90 footcandles on upper vertical surface and 50-fc on horizontal desk top.

lamps to shield and diffuse the light source.

Color of the panel is sea green having a reflectance factor of 40%, and lamps are standard cool white. Illumination on the upper vertical face of the board is 90 footcandles and it is 50 fc on the horizontal surface of the control desk.

The editors would like to mention that the visual effect is more pleasing than the accompanying photograph indicates, for (contrary to our usual practice) supplemental lighting was used by the photographer when taking the picture, thereby creating a shadow effect which otherwise would be absent.

Black Light and Flasher Units Add Interest to Florist Shop

LIGHTING

The use of black light, multi-circuit control timeclocks and flashers in addition to fluorescent and incandescent lamps, louvers, lenses and coves makes Stein Flowers of Milwaukee an outstanding example of a progressive and comment-provoking commercial venture. Lighting intensities vary between 45 and 100 footcandles for general illumination, while spotlights accent featured displays well above these average figures. Designed by archi-

ALL-GLASS EXTERIOR of this florist's shop effectively serves as giant showcase to display attractive floral arrangements, garden accessories, interior decorative treatments and praiseworthy lighting installation.

SORGEL AIR-COOLED Dry-Type TRANSFORMERS

for Every Purpose

To operate 120 volt lighting and portable equipment from 240, 480 or 600 volt power circuits, and higher distribution voltages.

To operate special equipment from standard circuits.

To change odd voltages to standard voltages and phase changing.

For high voltage interior distribution systems, such as 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts.

Underwriters' Approved — SORGEL dry-type transformers are Underwriters' approved in all ratings covered by the Underwriters' Re-examination Service, both single phase and 3-phase.

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For interior high voltage distribution systems, with either dry-type or Askarel-cooled transformers, which are also procurable with any make or type of switchgear, and from any substation manufacturer. 100 to 3000 Kva and up to 15,000 volts.

Complete Line

1/4 to 3000 Kva.
Single phase and poly-phase.

All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts.

Also
Special Transformers
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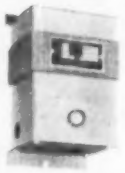
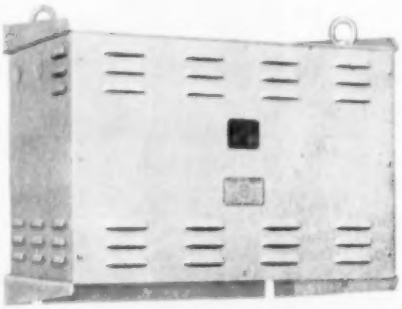
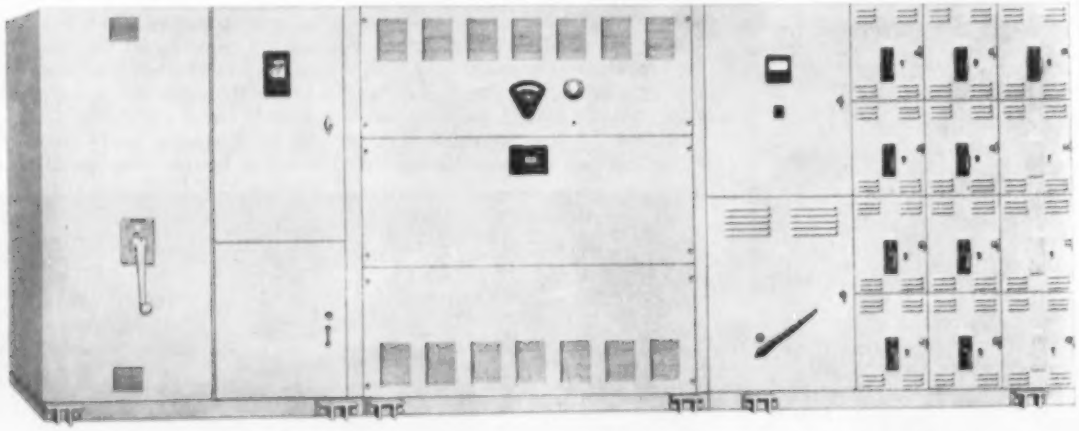


1/4 Kva single phase 480/240 to 240/120 volts



15 to 50 Kva 3-phase. Wall mounting type



Substation, with primary switchgear—metering—2000 Kva 3-phase, 13,200 volt dry-type transformer—secondary circuit protection. Shipped completely assembled, wired and tested, ready to connect to lines. Nothing else to buy, make, or assemble.

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wisconsin

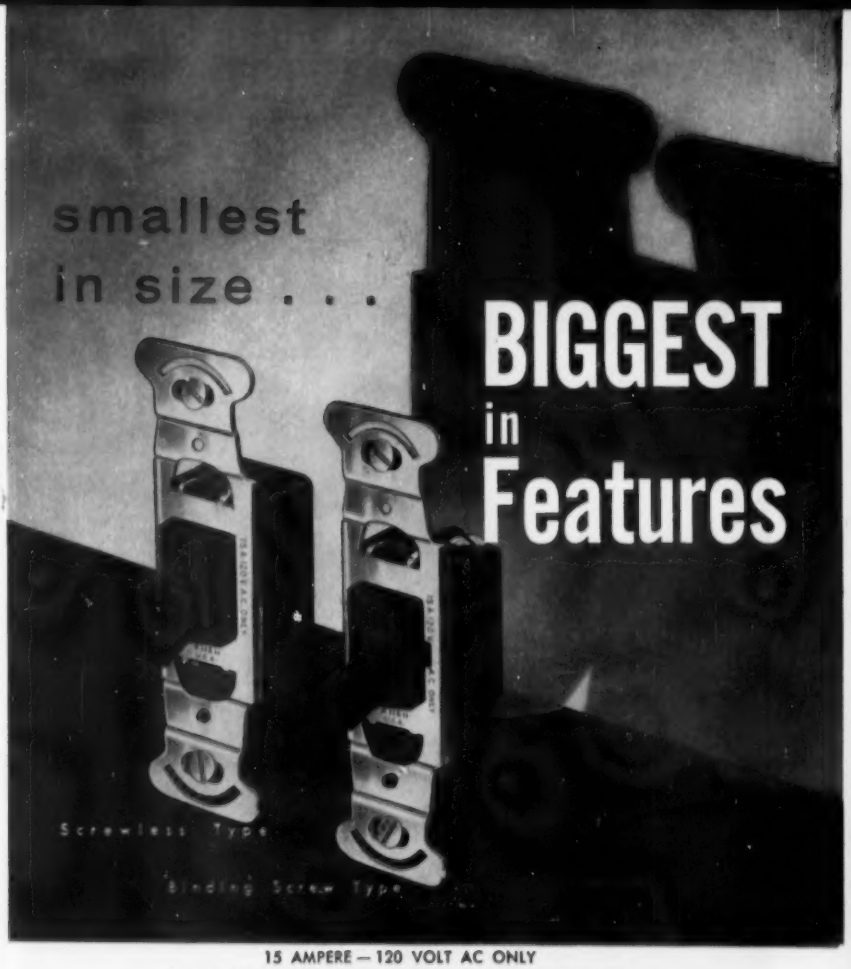
40 years' experience in the development, manufacturing, and application of Transformers

SEMI-RECESSED UNITS above main floor section of shop are 4-by-4 and 1-by-8-ft fixtures containing warm-white fluorescent lamps arranged on 6-in. centers. Adjustable eyeball spotlights serve to accent featured displays.

PERFORATED-CONE pendant units, equipped with 100-watt lamps and Fresnel lenses, deliver from 60 to 100 footcandles to displays placed directly beneath them. At right may be seen section of louvered ceiling that combines R-40 floodlamps with black-light fluorescents.

tect Carl E. Reimenschneider, the attractive shop combines a variety of interior wall surfaces and an all-glass exterior shell that effectively serves as a mammoth showcase for flowers, plants, gifts and garden accessories highlighted within.

As indicated by the accompanying photographs, PAR-38 floodlamps are recessed on 7-ft centers into the overhanging exterior canopy to illuminate the terrace, steps, stone facing of the building and landscaped grounds adjacent to it. These floodlamps are normally white, although the use of color is periodically included to heighten special seasonal atmospheric motifs. Large free-standing translucent plastic letters atop the canopy, lighted by enclosed cold-cathode tubing, draw additional night-time



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You'll like the Junior Quiette Switch for its small size that means ample wiring room . . . for the built-in shunts in some models that eliminate splicing . . . and a choice of either Binding Screw or Screwless Wire-Lock Terminals, as you prefer.

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Available in single pole, double pole, 3-way and 4-way with Ivorylite or Brown handles. Listed as standard by Underwriters' Laboratories.

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Utility—good looks—rugged, maintenance-free McPhilben quality! Who else but McPhilben packs so much in so versatile a line of lighting fixtures? Who else but McPhilben offers the smart simplicity of years-ahead styling, the inherent permanence of anodized cast aluminum construction . . . the fine attention to engineering detail, the range of applications . . . the superiority of performance?
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45-46 VT (guarded)

COLUMN AND ISLAND DISPLAYS are highlighted by adjustable louvered spotlights while ornamental pendant units are again used in this section to increase lighting intensities on gifts arranged on tables and glass shelving along redwood walls.

attention to the shop's attractive exterior.

In the show-window peninsula, just to the right of the front entrance (and measuring approximately 12 by 12 ft), flowers are arranged beneath a completely louvered ceiling that shields three rows of 150-watt R-40 floodlamps (ten lamps per row) and eight 40-watt black-light fluorescents. Alternate floodlamps are staggered between alternate wiring circuits so that basic horizontal-plane lighting intensities may be either 50- or 100-fc. These floodlamp circuits are also controlled by flashers and time clocks, thereby making it possible to alternate normal-color with black-light fluorescent displays on any pre-selected interval, then have the lights switched off automatically late in the evening. Here, again, floodlamps of different colors are occasionally used, with flashers arranged for either alternate or simultaneous operation so as to rotate or blend the colors so used. Floor-to-louver height in this window is 8 ft, while the cavity above the cellular ceiling measures 18 in.

Six additional lighting treatments are used to illuminate the main (30-by-40 ft) interior section of the flower shop. These include (1) semi-recessed 4-by-4 and 1-by-8-ft Neo-Ray luminous panels in the central area, (2) a continuous 1-ft-wide louvered cove above and in front of wall cases and peg boards, (3) an 11-by-4-ft white-enameled eggcrate panel installation adjacent to the rear entrance, (4) a total of 19 Prescolite semi-recessed adjustable eyeball units equipped with

Not so long ago, people rarely drove their automobiles at night, because poor street lighting constituted a considerable safety hazard. Nowadays, streets are brilliantly lighted and night driving is taken for granted.

Simplex ANHYDREX Series Street Lighting Cables play an important part in keeping the nation's thoroughfares brightly and safely illuminated. These extremely lightweight cables are completely dependable, are easy to splice and are unaffected by moisture. Available in a variety of sizes to meet existing requirements.

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79 Sidney Street, Cambridge, Mass.

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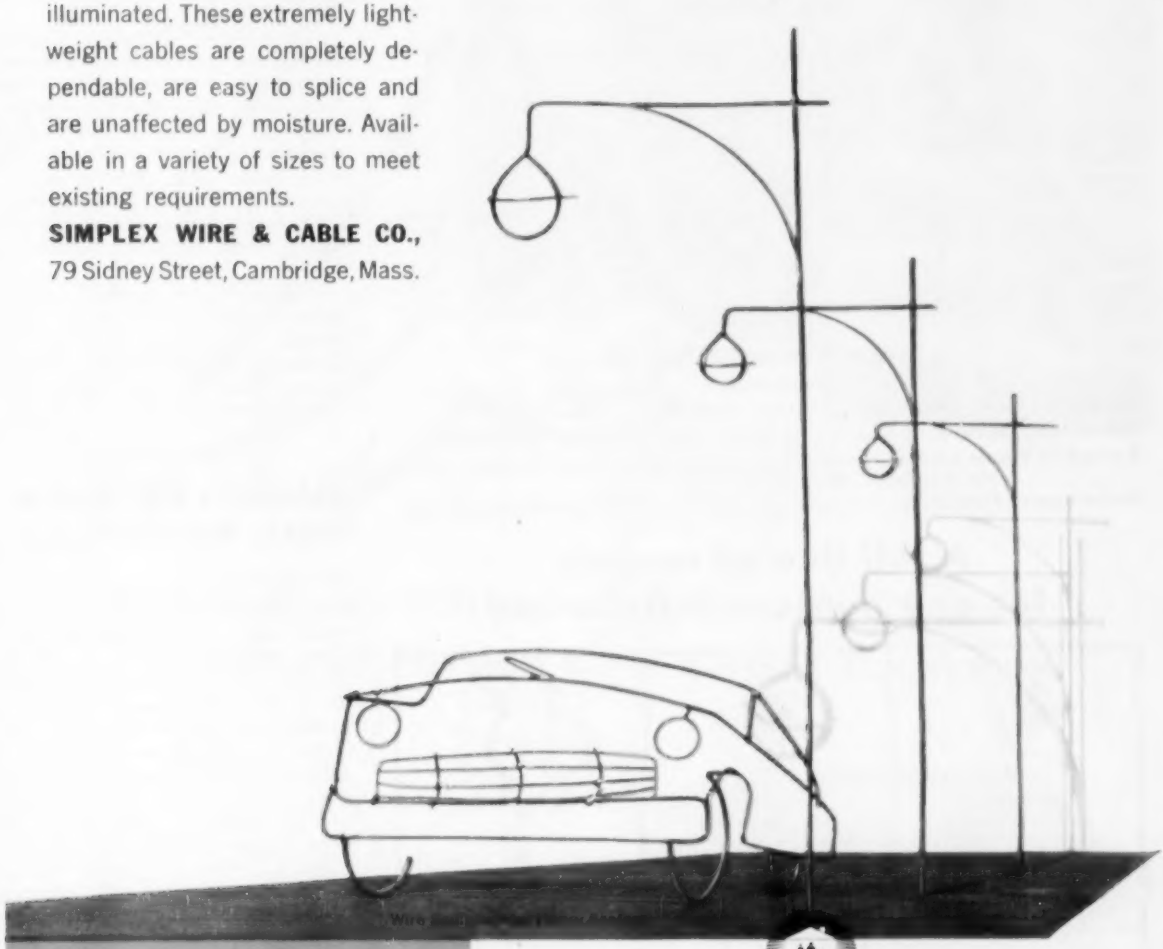
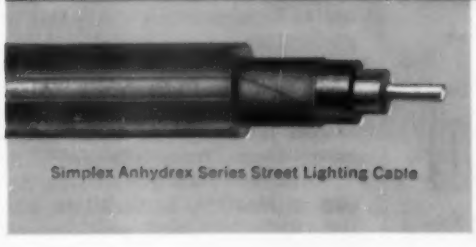




Simplex Anhydrex Series Street Lighting Cable

LIVE BETTER ELECTRICALLY

Simplex

New Stonco No. 6400 Superspot gives 121,500 CP for only 500 watts

and adapts easily for all outdoor lighting jobs

The most powerful sealed beam lamp ever designed for commercial service is the bright power heart of the new Stonco 6400 Superspot. Over 121,500 candlepower is packed into a long-throw beam that consumes only 500 watts current.

Ball parks, athletic fields, golf driving ranges, freight terminals, industrial yards — these are just a few of the places where the Stonco 6400 gives you more light, where you need it most, for less money.

Precision-designed for efficiency, and precision-built for long trouble-free service, the 6400 is extra-heavy-duty cast aluminum, with big internal and external ribs to provide greater surface for rapid heat dissipation. Simple installation, no maintenance, and the *lamp stays bright for life.*

Look at these special features

Raintight: For all-weather use in any position.

Double the Lamp Life: Rated 2,000 hours — twice that of ordinary lamps.

Pre-Aiming Quadrants: Both vertical and horizontal for easy pre-positioning.

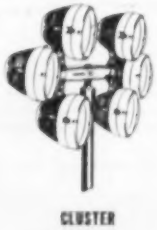
Locked-In Focus: Interlocking teeth anchor the unit firmly in position as set, regardless of vibration, pole sway or shock.

Maintenance Free: Never needs cleaning — sealed beam reflector stays mirror bright.

A full line of models for any outdoor installation

STONCO PORTABLE 6400
Only 13 pounds light, but with big lighting capacity right in your hand. Ideal for all field work, fire departments, emergency crews.

STONCO SPORTSLIGHTER
A new way to have top professional athletic field lighting, well within a tight budget. Write for full details.



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For outdoor lighting, it's Stonco

Stonco

ELECTRIC PRODUCTS CO.
Kenilworth, New Jersey

PAR-38 spots for highlighting featured items, (5) numerous decorative Globe perforated-cone Fresnel-lens pendant lamps delivering from 60- to 100-footcandles to plants beneath them, depending upon length of supporting stems, and (6) recessed 150-watt R-40s above and in front of the large glass-front refrigerator. All fluorescent lamps are warm-white rapid-start; six being used above the 4-by-4-ft central translucent square, and two rows being located above all other plastic or louvered panels. Lamps are generally positioned 1 ft above their respective shielding mediums and lamps used in the louvered wall coves are placed 16 in. out from the wall plane.

Throughout the store lighting intensities average 100 fc although, as mentioned in respect to certain local areas, intensities actually vary from 45 to 150 fc overall. All circuits except those controlling wall coves (12 circuits in this group) are automatically switched off through action of a time clock, while coves remained lighted all night.

Wall surfaces include natural stone, redwood planking vein-rubbed with white lead, and tan pegboard. Acoustic ceiling tiles are cream. Floor tiles are tan and ivory with red-rust accents.

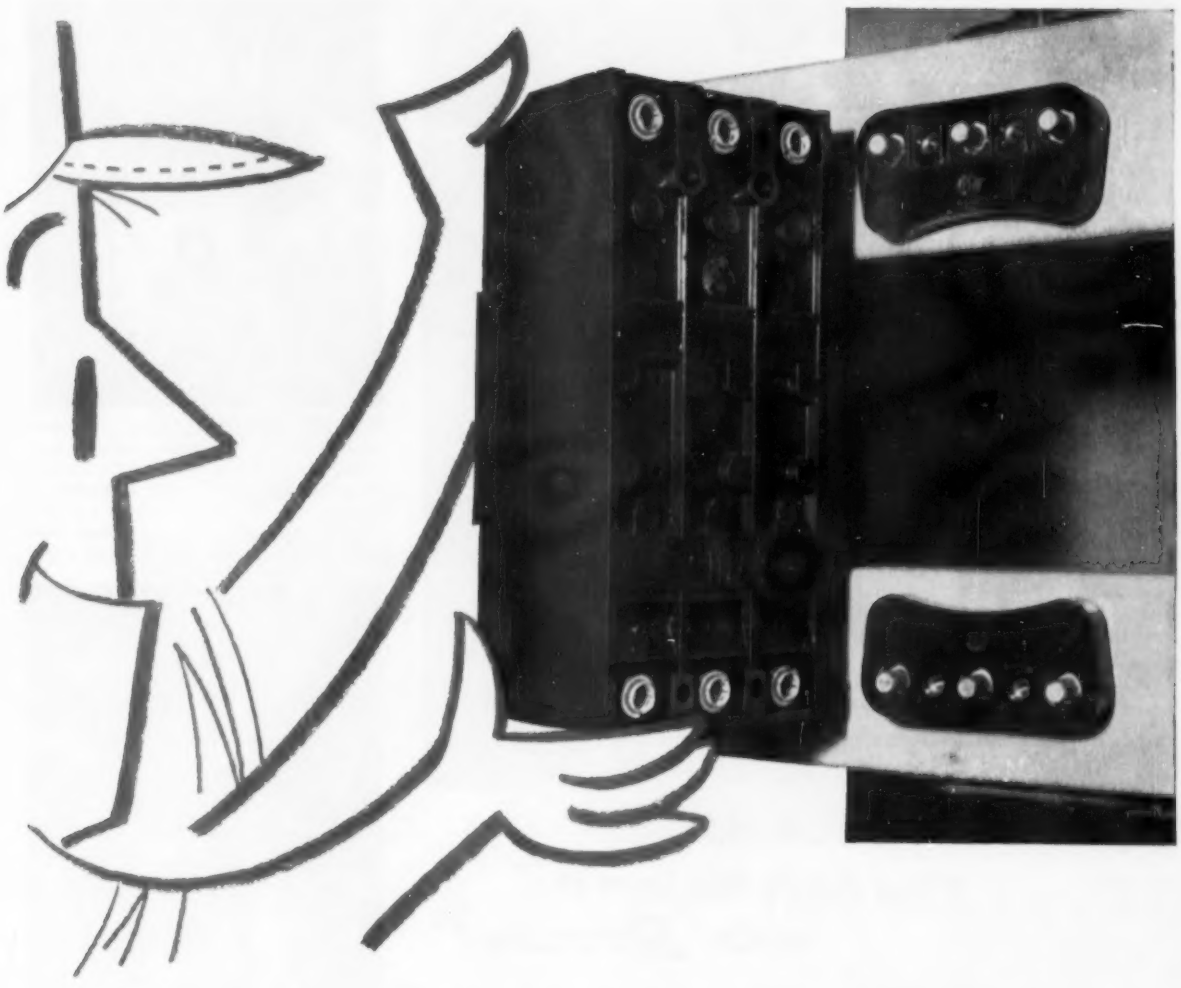
Automatic P-B Control Boosts Mill Efficiency

MODERNIZATION

Six 440-watt ball-mill grinder drive motors in the Diamond Portland Cement plant at Middle Branch, Ohio, formerly required three separate manual operations to start and synchronize each unit. Not only were these multiple procedures time consuming, but maintenance was high because all control equipment was located in areas of heavy dust concentration.

As a result of modernization, however, these drive units are now placed in operation by means of synchronous motor starters which are in turn remotely controlled by pushbuttons.

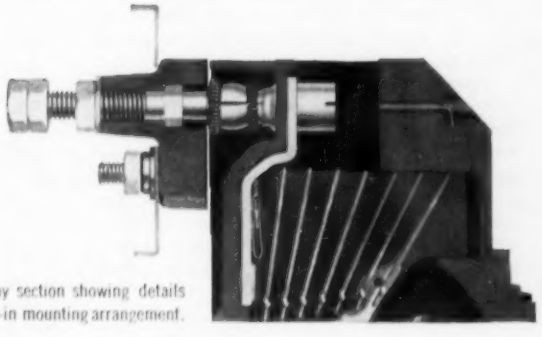
Starters, designed by EC&M of Cleveland, are individually housed in totally-enclosed steel cabinets located in a separate room to remove them from the normally dusty cement-plant atmosphere. Access to starters, to facilitate routine inspection and servicing, is provided by means of hinged doors on cabinet fronts.



Ordering Switchboards? Specify Plug-In Mounting of Molded Case Circuit Breakers

Consider the advantages of I-T-E Plug-In Mounting. The added safety of concealed breaker terminals with no live parts exposed. The flexibility of changing breaker ratings within a frame size. The ease of installation and removal. When you do, you'll specify switchboards with this time-proved method of installing molded case circuit breakers—used for many years in maritime switchgear and approved by Underwriters Laboratories Inc.

I-T-E plug-in molded case circuit breakers are available in ratings from 15 to 600 amp, up to 600 volts a-c, 250 volts d-c. Contact your I-T-E representative or leading independent switchboard manufacturers for details. Or write Small Air Circuit Breaker Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Phila. 30, Pa.



Cutaway section showing details of plug-in mounting arrangement.

I-T-E CIRCUIT BREAKER COMPANY

Small Air Circuit Breaker Division

If you can reach it, you can fasten it with *Ramset*®

One-hand operation in awkward places is simple with a light RAMSET powder-actuated tool. It's ideal for ladder and scaffold work.

For anchoring to concrete or steel, the new DUO-JOBMASTER® sets ¼" and ⅜" fasteners interchangeably—merely by switching barrels right on the job! Yet the tool does not change size or weight!

There's no need to exert physical power when you use RAMSET. Let the power charge do the work! No wires, no hose to drag or untangle. RAMSET is entirely self-contained.

Tough jobs are now easy with RAMSET. No more drilling, filling, plugging and bolting. RAMSET fasteners are set at the press of the trigger—have greater holding power than old-style methods.

Speed your production, make work easier for operators, cut your costs, get more dependable performance by using RAMSET whenever fastening to concrete, steel or other hard materials.

Write for free new catalog, ready for you now.

companion tool

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TRADEMARK

Baby brother to RAMSET, this hammer-in tool uses no cartridge, but makes your own hammer power more effective. For masonry, mortar joints, cinder block. Ask for literature.

Ramset Fastening System
WINCHESTER-WESTERN DIVISION
OLIN MATHIESON CHEMICAL CORPORATION

12105-K BEREA ROAD • CLEVELAND 11, OHIO

PUSHBUTTON PANEL located adjacent to 440-volt grinder motor remotely controls motor starter that automatically brings drive unit into synchronism. Starters are housed in totally enclosed cabinets in separate room to remove them from dusty atmosphere of cement plant.

BEFORE MODERNIZATION program was launched, all control equipment was exposed, and the routine of starting and synchronizing the six ball-mill drives required three separate manual operations for each unit.

To permit plant operators to start motors from local positions, the motivating pushbuttons are located on control panels placed near each drive motor out in the plant. And, when one of these starting buttons is pressed, the related motor starter automatically supplies field control and excitation to bring the related motor into synchronism and lock it there. Field removal and re-application also occurs automatically in the event that a voltage dip or momentary overload causes the motor to pull out of step. This feature for quickly returning drive motors to service is another time saver and lessens necessary supervision.

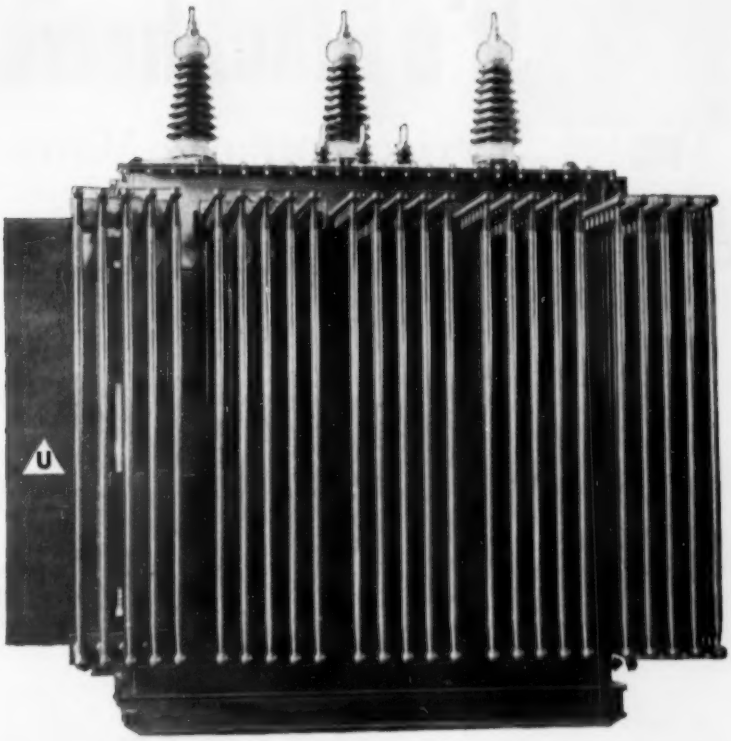
Savings introduced by these features far outweigh the cost of additional wire and conduit involved.

Uptegraff LIQUID-FILLED *Transformers*

3 KVA

to

10,000 KVA



a complete line —

STANDARD and SPECIAL RATINGS

ENGINEERING DATA

Helpful material for planning electrical systems

1. POWER. Bulletin 133 contains dimensions, performance data and other essential information on Uptegraff Power Transformers, 750 to 10,000 KVA.

2. LOAD CENTER. Uptegraff liquid-filled Load Center Transformers in eighteen ratings, from 150 to 2500 KVA. 3-phase are described in Bulletin 132-A.

3. DISTRIBUTION. This bulletin contains detailed specifications of Uptegraff liquid-filled Distribution Transformers, 150 to 500 KVA inc.—ratings, performance data, dimensions, weights and other data. Bulletin 136.

4. OVERHEAD. Characteristics, dimensional details, ratings and other data on Uptegraff type UD Overhead Distribution Transformers are given in Bulletin 135.

When requesting copies of above publications, please write on your company letterhead.

All standard commercial ratings from 3 to 10,000 KVA are available in the complete line of Uptegraff Liquid-Filled Transformers—and special designs are readily available for applications where standard units are not entirely suitable. Prompt deliveries can be arranged, and all Uptegraff Transformers are fully guaranteed. They meet or exceed ASA, NEMA and AIEE standards.

Extensive experience by this firm, which has specialized exclusively in the design and manufacture of transformers, assures the efficiency, dependability and long life of Uptegraff products. The Uptegraff Engineering Data Books illustrated at the left provide a wealth of information useful to executive, engineering and operating departments. We will gladly send copies to anyone interested. Please write on company letterhead.

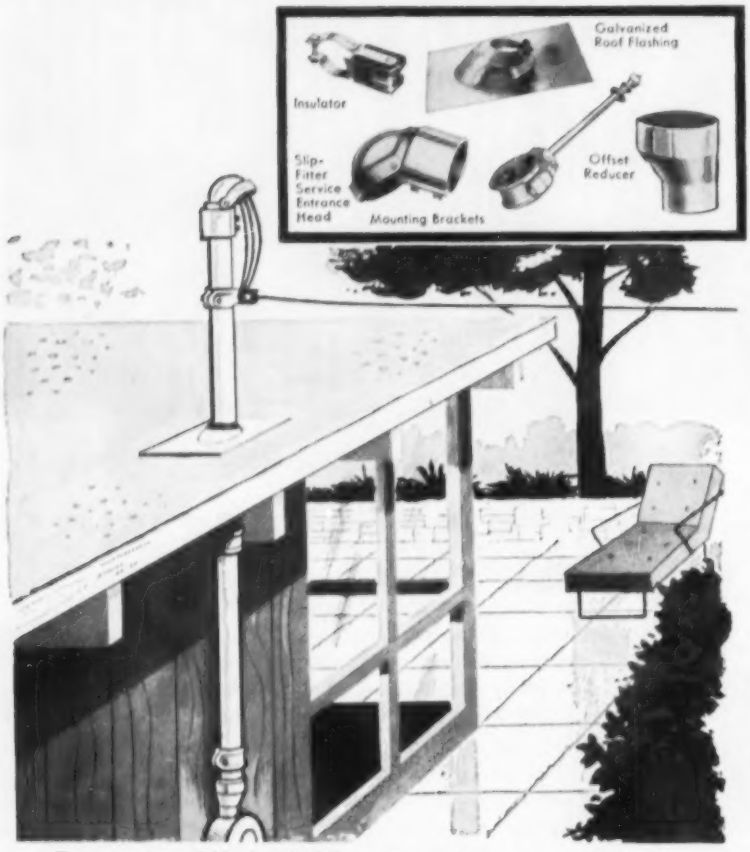
R. E. UPTEGRAFF MANUFACTURING CO.

Scottdale, Pennsylvania

For quick, easy installation

It's Blackhawk

Service Entrance Masts



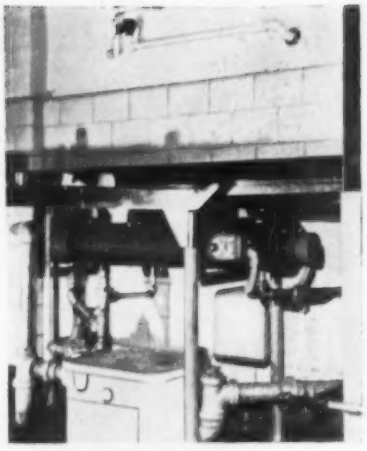
For an easy, quickly installed Service Entrance Mast, the name to remember is Blackhawk. Blackhawk . . . with Slip-Fitter Service Head Entrance . . . with new combination 2" and 2½" slip fit unit with 1¼" service entrance cap. Blackhawk . . . with the service entrance head that slips over any conduit . . . needs no threads . . . no extra clamping devices . . . no special tools for installation. Simply tighten the two set screws and the Blackhawk Slip-Fitter Service Entrance Head is securely in place. In the Blackhawk entrance head the housing frame is the slip fitter . . . the set screws tighten directly on the conduit so only the heads show.

The Blackhawk Service Entrance Mast is available in complete kits or as separate fittings. Whichever way you buy, either the complete kit or individual fittings, the name to remember in service entrance masts is Blackhawk.

Blackhawk Industries

BLACKHAWK INDUSTRIES

DUBUQUE, IOWA



How to Heat Rinse Water Economically

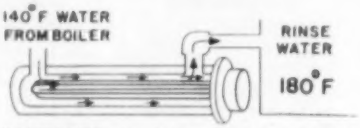
HEATING

The problem of obtaining rinse water for commercial kitchens at temperatures that meet state and city health codes can be solved effectively and economically by a simple method, using electric heat. The main supply of hot water is simply boosted to the required temperature by installing an instantaneous circulation heater in the hot water line near the washing machine.

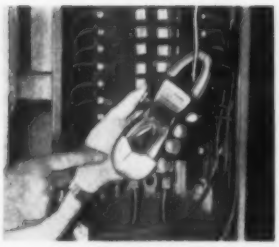
This problem was faced recently by an industrial cafeteria. In the midst of remodeling its kitchen facilities, it was found that water from the central hot water system was heated only to 140° F., 40° short of the required 180° F. Investigation showed that installation of an ordinary type of supplementary heating system would be costly, and that furthermore there was no space for such a system. So, instead, a compact and economical Chromalox electric circulation heater was selected and installed.

This heater was easily installed in the unused space under the washing table. It was supplied as a completely "packaged" unit, with built-in insulation, pipe connections and thermostat, to assure constant temperature at minimum cost.

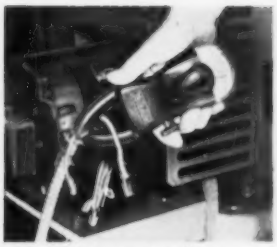
This machine now meets health regulations by thoroughly sanitizing all ware. In addition, the heated dishes air-dry rapidly, eliminating hand drying.



PACKAGED circulation heater is a complete unit, easily installed in the hot water supply line.

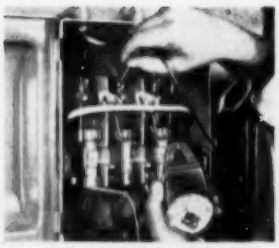


Show need for additional service



Take current readings without shutdown

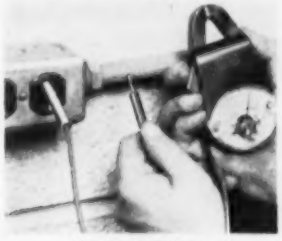
Check appliance current at plug



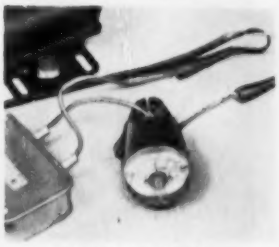
Instantly determine if fuses are good

Know if load is balanced

13 different jobs that call for an AMPROBE



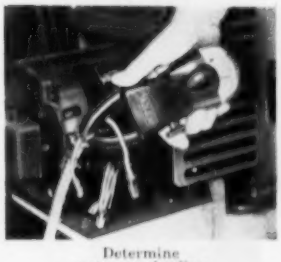
Determine hot leg of receptacle



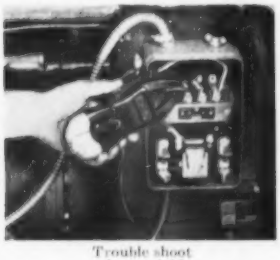
Check capacity of motor capacitors

Use for periodic motor checks

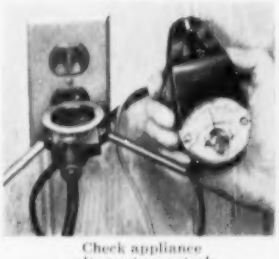
Know if windings are grounded



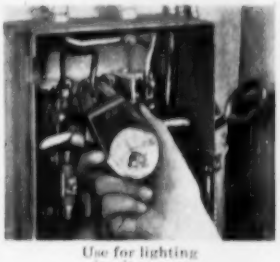
Determine motor overloading



Trouble shoot relays quickly



Check appliance voltage at receptacle



Use for lighting circuit surveys

Don't guess at it. *Amprobe it.*

You'll save time, money, and costly mistakes on the job by reaching for your Amprobe. It's not just an ammeter, not just a voltage-tester. It's both! Amprobe measures voltage and current—instantly, accurately, safely—without shutting down equipment. And there's a model that fits your needs perfectly.

Expensive? Not all all. You can select an Amprobe for as little as $19.85—just a few dollars more than an ordinary voltage-tester. See your electrical wholesaler today.

Amprobe is a division of Pyramid Instrument Corp., 630 Merrick Road, Lynbrook, New York, manufacturer of REMCON simplified low-voltage switching devices.

AMPROBE

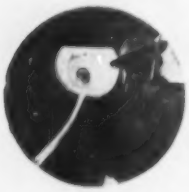
13 models to make your work easier, faster, surer

There's a model for every job, every budget: from 10 amps and 250 volts to 1200 amps and 600 volts AC; from $19.85 to $67.50.

Ask these questions, too, when you judge a fluorescent lamp...

Is your investment protected?

Check Westinghouse Fluorescent Lamps against any other brands you are now using. Check them for maintained brightness, long life, uniform appearance. If you are not entirely satisfied on all counts, your full purchase price will be refunded.



Is it built with tailored glass?

Quality of glass in a fluorescent lamp directly affects lamp performance. Westinghouse makes all of its own fluorescent lamp glass, tailoring it from silica to finished tubing specifically for fluorescent service.

Is it the correct type, size and color for the lighting job to be done?

In the Westinghouse fluorescent family of 290 different lamps—including Slimline and Rapid Start—there's a type and size precisely right for every office, plant and merchandising application. Colors include seven different shades of "white" alone.

For the full story on how to get more for your money in fluorescent light, contact your Westinghouse Lamp Representative.

WATCH WESTINGHOUSE

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

TEST-PROVED MAINTENANCE

(CONTINUED FROM PAGE 117)

fluorescent luminaires; is fitted underneath with storage cabinets and drawers, and is served on all sides by the crane it surrounds.

Another item of equipment meriting mention is a plant-fabricated solvent tank equipped with a hinged steel cover that is held open by a chain containing a fusible link. Melting of this link would permit the cover to automatically drop shut due to gravity. Simultaneous melting of another fusible element would activate a CO_2 system, with spray being introduced into the tank just above the level of the solvent contained therein. Both of these features provide safety insurance against damage from a flash fire, for a sudden rise of temperature would promptly melt the fusible tripping elements and the fire would be instantly confined and smothered. The likelihood of a fire occurring, however, is a remote one, for the solvent's flash point exceeds 200 degrees and immersion of objects above this temperature is unlikely.

Plantwide Transportation

Due to the physical size of the plant structure and exterior storage areas, thought has also been directed towards the obtainment of rapid transportation for maintenance personnel and materials. As a result, aisles are liberally sized and kept clear to permit free movement of jeeps, pick-up and lift trucks, while maintenance men also use bicycles extensively whenever they are not encumbered with bulky or weighty equipment. Portable work benches on castors are also used to facilitate on-the-spot repair work.

These items of mobile equipment are specially designed to furnish maximum service to plant electricians; trucks being equipped with ladder racks and bins, bicycles fitted with wire basket carriers to receive snap-in canvas retainers for small parts and tools, and mobile work benches provided with vises and other basic essentials for performing pipe work locally.

Still other methods for transporting men and material (vertically) concerns the use of Skyhooks and special working platforms raised by fork lifts.

From a basket cage at the end of a Skyhook boom, a maintenance man can reach objects located 40 feet distant (in any direction) from the boom's base, and he can also remotely control the boom's azimuth and elevation. This permits him to obtain exact positioning of his working point. When lowered atop a gasoline-operated shop mule and jack-knifed into a folded position, the complete rig becomes a compact 5-by-20-ft plan with a 12-ft height, permitting its passage through any aisle, portal or doorway in the manufacturing area.

This extension rig is excellent for such high-level maintenance work as installing busduct plug-in devices or relamping high-bay or outdoor floodlight units. Incidentally, relamping these tower installations is on a modified-group replacement basis; all-night lights (those left on for security purposes) being cleaned and relamped every six months while the other lamps are group-replaced once a year.

To raise electrical workers to lesser heights, platforms are positioned at convenient levels by forklifts. These platforms are equipped with structural sub-base, ladder, mesh parapet and tool tray; and they are used for servicing such items as unit heaters, overhead door motors, jib cranes and low-bay lighting fixtures. For all medium-level work, therefore, these lift-platforms constitute another important maintenance aid.

Celebrating a quarter-century of existence and three years as a General Motors division, Euclid continues to grow in physical size, prestige, sales and scope of products. Due to its recognition, endorsement and progressive practice of electrical maintenance, this plant constitutes an outstanding example of an industrial organization kept at peak performance. And due to intelligent analysis and prompt attention to electrical problems, the plant stands out as a model for production, efficiency and safety.

LIVE BETTER ELECTRICALLY

how to judge a fluorescent lamp . . . point no. **9**

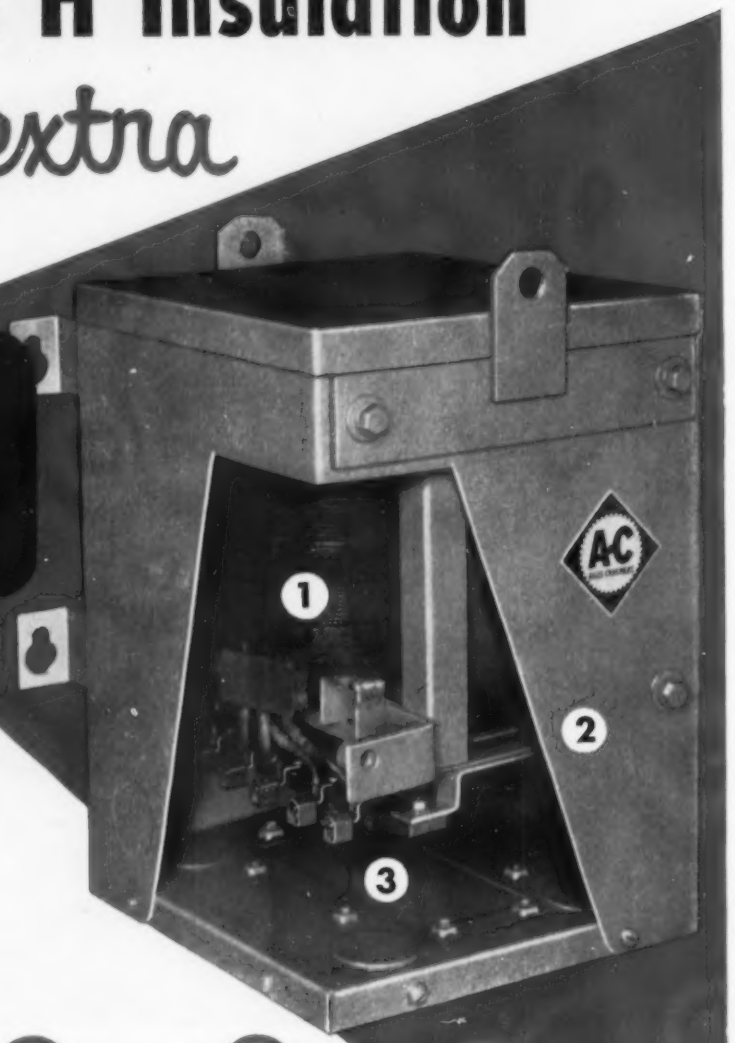
ask about **ELECTRODE QUALITY**

Better electrodes in a fluorescent lamp mean *longer lamp life*. That's why Westinghouse cuts no corners in its electrode manufacture. All Westinghouse electrode coil wire, for example, is drawn through diamond dies. Some of it has to be drawn so fine that a single pound will extend from New York to Pittsburgh. Thanks to constant development of new and better ways to make fluorescent lamp electrodes, Westinghouse has *tripled* the life of its fluorescent lamps since 1948.

WATCH WESTINGHOUSE
*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***

✓Totally Enclosed
✓Class H Insulation
-at no extra cost

ALLIS-CHALMERS Dry-Type TRANSFORMERS



FORGET all about maintenance with this Allis-Chalmers totally enclosed, 150 C rise, dry-type transformer. No dirt, dust, moisture or lint can get at it. Use it indoors or outdoors. It is completely weatherproof.

Class H insulation used throughout the coil structure results in long insulation life. Case temperatures are low—do not exceed maximum of 40 C rise. All safety requirements are easily met. No vaults or barriers are needed.

Modern design features result in a compact, convenient transformer that will give years of satisfactory operating life. All these advantages are available at no extra cost.

For Complete Information, call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

1 Coil has maximum insulation life with Class H (150 C rise) insulating materials.

2 Simple, sturdy, totally enclosed weatherproof case has just one welded seam.

3 Recessed bottom plate has eight bolts for positive closure, yet gives quick accessibility.

AC ALLIS-CHALMERS

ALLIS-CHALMERS

LIVE BETTER ELECTRICALLY

A-5126

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Product News

Loadbreak Tool (1)

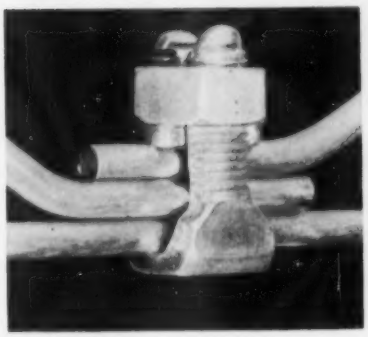
A portable loadbreak tool, known as Loadbuster, which can be carried conveniently on utility line trucks and applied instantly to any S&C disconnect or cutout on a distribution system to break load current. By means of this tool, which may be used over and over again, every disconnect and cutout on a system may be operated as a load interrupter switch. Safety is afforded the lineman performing the opening operation, since there is no external arc resulting from the load interruption. Tool is, essentially, a portable load interrupting unit, or loadbreak tool, which can be carried on line trucks ready for instant use. Attached quickly to a universal pole, it can be manipulated freely, approaching the disconnect or cutout to be opened from any angle, direction, or distance. It is light in weight. To break load, the tool is hooked across the upper contacts of an S&C disconnect or cutout which is then opened in the normal way. A twist of the pole disengages the tool, releasing it for immediate loadbreak service elsewhere. The tool provides arc-free circuit interruption at any distribution system voltage through 14,400 volts. It is able to break all load currents through 400 amps, as well as associated magnetizing and charging currents. It can switch all pole-top capacitor banks.

S&C Electric Company, 4435 N. Ravenswood Ave., Chicago 40, Ill.

Magnet Wire (2)

An improved film-insulated solderable magnet wire, called Analac. It can be used like Formvar or plain enamel, but without the necessity of removing the insulating film to make joints either during the winding process, or when attached to lead wires or to some other conductor. Analac is colored a bright red with a stable dye used for identical applications. Offered with both single and heavy grades of insulation, Analac has excellent abrasion resistance, and will withstand all normal winding conditions. Dielectric loss, dielectric strength and dielectric constant all make it suitable for use in windings that generally are used on electronic devices. It may be removed from spools by spinner dereeler, in which the wire is taken over the flange, or by direct pay-off from the rotating spool controlled by a tension device.

Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.



Connectors (3)

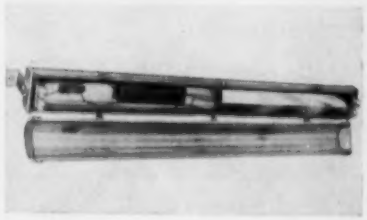
Three-wire Servits for conductors through No. 2 solid, have been added to this line to meet the needs of utilities and REA cooperatives using split-bolt connectors in 3-wire applications. They are designated KS17-3 for No. 6 solid copper; KS20-3 for No. 4; and KS22-3, for No. 2. All have REA approval. They include closely dimensioned threading for easy bolt starting and minimum frictional losses in tightening, and a flat-sided head for good wrench-gripping surfaces. It is reusable and can take the same tightening torque in reuse as the first time.

Burndy Corp., Norwalk, Conn.

Strap (4)

A new type of metal strap that "snaps-on" pipe, rigid and thinwall conduit. The secret of the "snap" is a bump inside the strap. As the strap is pressed on, the bump causes a slight springing action which holds the strap in place. Ribbed construction adds to the snap and provides rigid support of the conduit or pipe. Straps are made of heavy gauge steel and zinc plated after fabrication. They are available in six sizes from ½ in. to 2 in. for thinwall conduit, and seven sizes from ½ in. to 2 in. for rigid conduit and pipe. The size is stamped on each strap.

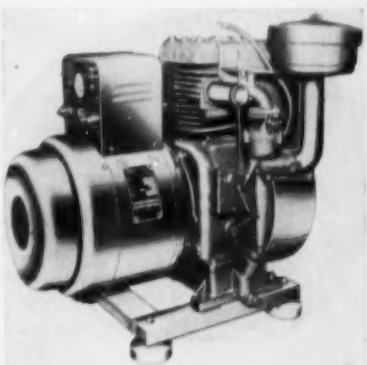
Holub Industries, Inc., Sycamore, Ill.



Fluorescent Fixtures (5)

A weatherproof, aluminum fluorescent fixture for lighting tunnels, underpasses, loading docks or shed areas. Weighing 50 pounds and measuring 72½ in. long, the fixture (type HLG) consists of two assemblies—a housing for lamps, ballast, wiring, and reflectors, and a door, which supports a gasketed, clear ribbed plastic cover. Door opens by turning three catches; when open, it can be allowed either to hang on its hinges or be removed by unhooking hinges. Removal of one reflector section provides access to terminal block and ballast. By means of L-shaped brackets, the fixture can be mounted continuously in rows on ceilings or walls, then rotated horizontally to any desired position. Fixture uses 95-watt, rapid start outdoor type fluorescents, either cool or warm white.

Crouse-Hinds Company, Wolf and Seventh North Sts., Syracuse, N. Y.



Generating Plants (6)

Two direct-drive generating plants have been added to the Winco line of engine-generators, both designed to run at 1800 rpm. The Winco Series 2B23S4D is rated at 2,000 watts, with plenty of intermittent overload capacity. The 102B14S4D is rated at 1,250 watts, with plenty of margin for temporary overload. Both units are available with either manual or remote start.

Wincharger Corporation, Sioux City, Iowa.

midwest

A Midwest quality fitting. "Quality" is just a condensed way of saying: "Getting the total job done — right — with the most inexpensive combination of material and man hours." Engineering and producing quality fittings to meet the highest standards of electrical wiring installations, is our objective at Midwest.

Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

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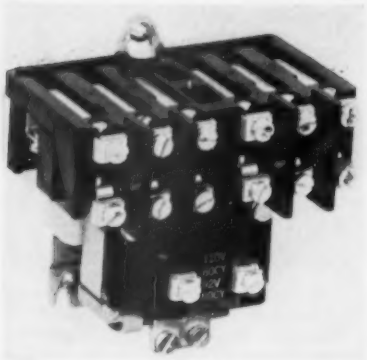
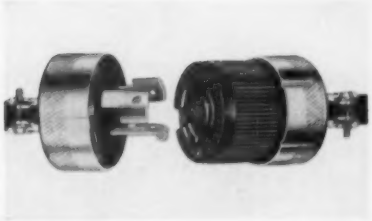
Chicago 12, Illinois



Relay (7)

A new 6-pole in-line 10-amp relay (NEMA Type AiB) designed for applications such as machine tools and control panels. Unit increases flexibility and conserves panel space by reducing the number of extra relays necessary in automatic control systems. A new saddle-type terminal permits wiring from four directions with either plain wire or crimped-on terminal connections. The relay is available in both standard and latched-in forms. All terminals of the new machine tool relay are accessible from the front of unit. Other features designed are captive clamps and large panhead screws on terminals. Relay is available in 2-, 3-, 4- and 6-pole models and in all voltages and frequencies up to 600 volts, 60 cycles. Machine tool relay contacts can be changed from normally open to normally closed or vice versa without additional parts. Unit can use the same six mounting screws (No. 10-32 max) as size 0 and 1 contactors.

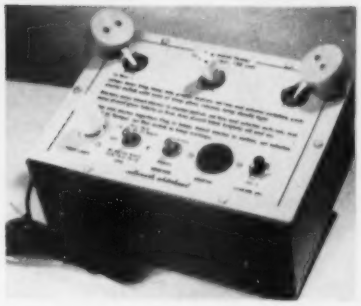
General Electric Co., Schenectady 5, N. Y.



Wiring Device (8)

A new "Super" Twist-Lock, featuring screwless pressure grip terminals. Wire terminals are pressure-clamped between sections. Front in each case is completely "dead", that is, no wires extend to the front. Wire ends simply press into their individual pockets and, with the dead front in position, are securely pressure-locked in place. Wire strands cannot contact one another or spread out and touch steel shell. This two piece design for the cap is unique, for it eliminates the need for a protective fibre disc and contributes to greater wiring safety and security. It is available in 2-wire, 20 amps, 250 volts; 3-wire 20 amps, 250 volts and 10 amps, 600 volts, ac only; 4-wire, 20 amps, 250 volts and 10 amps, 600 volts, ac only. Either the Super Twist-Lock cap or connector body can be used in conjunction with conventional units.

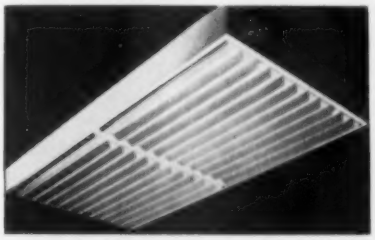
Harvey Hubbell, Inc., Bridgeport, Conn.



Fluorescent Tester (9)

This new tester will meet all fluorescent testing needs from 14 to 40-watt, both starters and lamps. It can be carried on service truck without fear of damage. Tests all bi-pin lamps, T-8 and T-12, 14- to 40-watt, including rapid start and circline. Tests all starters, FS2 to FS4, standard, no-blink, and reset. Tests starters and lamps separately or together. Operates on 110-120 volts, ac. Overall size is 8 by 6 by 5 in.

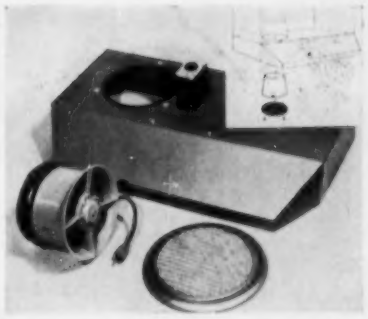
Culbreath Whitehead, 1334 Manatee Ave., Bradenton, Fla.



Fluorescent Fixtures (10)

New modular lumi-plastic panel fluorescent fixtures suitable for use in offices, banks, stores, corridors, etc. These panels offer high light transmission with low surface brightness. Easily washed with any detergent. All lamps and component parts are hidden from view. Fixtures may be used singly or ganged end to end for continuous rows of light. Heavy gage steel body finished in a hard baked white enamel. Fixture sizes are 24 by 24 by 4¾ in. and 24 by 48 by 4¾ in. Lamps used are four and six 20-watt T.S.; two, four and six 40-watt R.S.

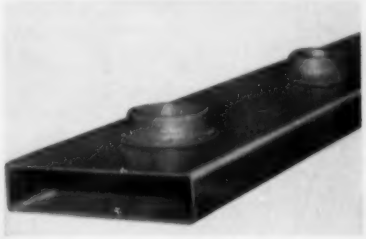
L. J. Segil Co., 2500 West North Ave., Chicago 47, Ill.



Ventilating Hood (11)

A new ventilating hood, named the Patrician. It is a complete system and includes four units: (1) the hood which blends with any room decor is available in 30-, 36-, 39-, 42- and 48-in. lengths—finishes are standard Coppertone as well as colors; (2) the 300 cfm axial flow ventilator which removes smoke, heat and fumes from air and exhausts them to the outside under pressure; (3) a 9-in. filter grille that takes the grease from the air being exhausted, is easily removed for cleaning; (4) an under-hood light has a single switch that operates both light and ventilator so that they can be turned on separately or simultaneously.

Trade-Wind Motorfans, Inc., 7755 Paramount Blvd., Rivera, Calif.



Duct (12)

Walker No. 4 duct measures 1¼ in. high by 6¼ in. wide and has an interior cross-sectional area of 8.75 sq in. It is available for use in Walker underfloor electrical distribution systems, either by itself or in combination with Walker No. 2 duct which measures 1¼ in. by 3¼ in. No. 4 duct is made from nominal 14 gauge steel and is protected inside and out by a layer of sherardized zinc and a specially formulated, corrosion-resistant outer coating. Duct is nominally furnished in 10-ft lengths with five factory pre-set inserts spaced on 24-in. centers. Inserts are generally 2.5 in. in diameter and are available in various heights. The open end of each insert is sealed with a removable steel cap, recessed to receive concrete. Inserts are threaded on inside to provide secure fitting connections. Blank duct, without inserts, is provided for home runs to distribution panels or cabinets.

Walker Brothers, Conshohocken, Pa.

Time Switches (13)

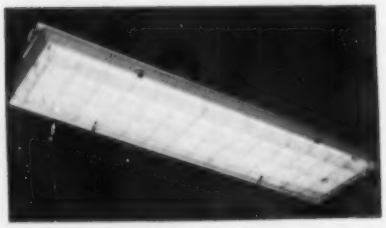
New Series 3300 weatherproof outdoor time switches, designed with up to eight on-off operations in a 24-hour period, have been introduced for industrial use, parking areas, playgrounds, parks and signs. Steel case is gasketed for dust resistance, zinc plated, and finished in baked gray wrinkle enamel. Each switch in series features a heavy-duty, low-temperature motor of special design for outdoor temperature variations. Operations may be set for temporary or seasonal lighting and as close as 90 minutes apart on the 24-hour dial. Trippers are removable. Oversized heavy silver button contacts are more than ample in area and thickness for rated loads. Case can be either locked or sealed, or both locked and sealed. Four 60-cycle, 30-amp models are available for 120- or 240-volt operation with either a single-pole, single-throw switch for 2-wire or a double-pole, single-throw switch for 3-wire. They are UL approved and may be pole or surface mounted and are 9⅝ in. high, 5⅝ in. wide and 4¼ in. deep.

Paragon Electric Co., Two Rivers, Wis.

Receptacles (14)

Several new fuse and sign receptacles have been added to this line. Among them is No. 266A, a bakelite fuse receptacle with a solid center contact, rated 30 amps, 125 volts. Diameter is 1⅛ in.; height is 1¼ in. Fuse mounting hole size is 1⅛ in. in diameter. Ear mounting holes are spaced at 1⅝ in. Also available with male push-on terminals instead of binding screws, and with insulating cover for binding screw terminals only. No. 266 is a bakelite keyless, medium-base, sign receptacle in one piece, rated 660 watts, 600 volts. It is available with male push-on terminals instead of binding screws and can be had with insulating cover for binding screw terminals only.

Circle F Mfg. Co., Trenton, 4, N. J.



Fluorescent Light (15)

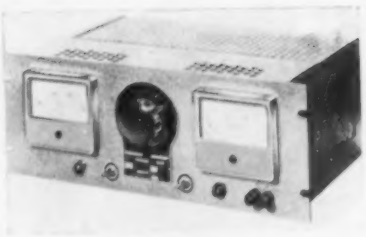
A 4-ft fixture for the new VHO (very high output) fluorescent lamp for industrial use. Features of the lamp are more efficient lamp diameter, rapid start continuous filament heating, "pressure control" center, and the use of neon gas instead of argon. Fixture is designed with a light green tint. Unit includes a slotted reflector and upper component. An 8-ft fixture will be available later on. There are already available two lamp models in the line—a 100-watt 4-ft lamp rated at 6,200 lumens and 200-watt 8-ft model of 13,250 lumens.

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

Telephone Switchboard (16)

Model 1B10 dial telephone switchboard has been designed for small offices, factories and institutions requiring three to ten private telephones. It comes completely equipped, and requires only the addition of telephones to be placed into operation. In addition to normal intercommunication service many special features are available such as paging, speaker phone, code call and others.

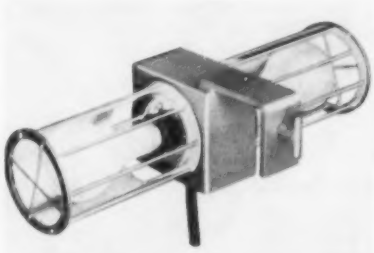
Telecom, Inc., 1019 Admiral Blvd., Kansas City, Mo.



Power Supply (17)

A new adjustable-output constant voltage dc power supply, called "DC Solavolt", combines a constant voltage transformer, a germanium rectifier, and a special high-capacitance filter section with small choke to yield laboratory standards of performance. Output voltage from the unit is regulated with plus or minus 1% with supply voltage variations up to plus or minus 15%. Ripple voltage is held within 0.10% (rms) at full load and nominal input voltage. All electrical circuits and terminals are insulated from ground, permitting operation at either polarity. Available in six stock models that provide output adjustable in different voltage ranges between 5 to 400 volts, and currents up to 7 amps. All six assemblies are arranged for relay-rack mounting on standard, 19-in. frame. Front panel is 7 in. high and chassis is 12¾ in. deep. Bulletin DC-245 is available.

Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill.



Cargo Light (18)

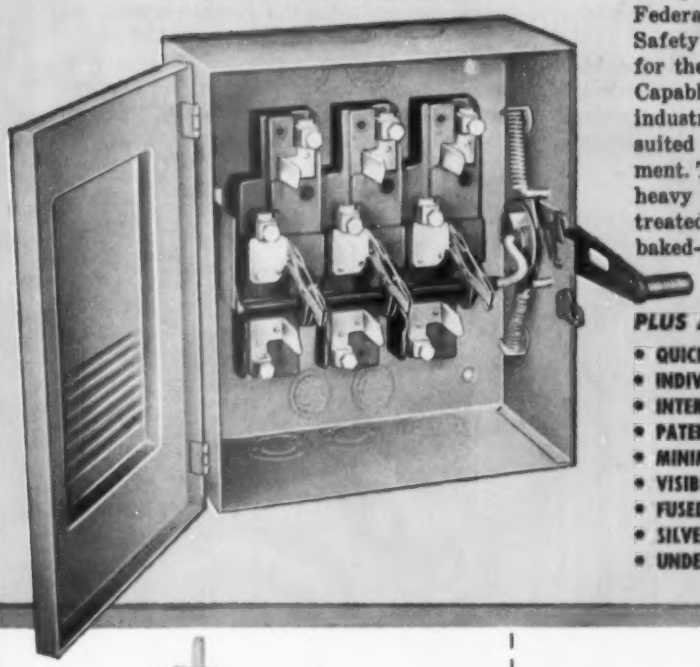
High-intensity illumination levels can be achieved in the interior of railroad freight cars or in other dark areas with this new cargo light. Unit will accommodate two bulbs up to 200 watts in size. Bulbs are supported in rubber-mounted sockets to resist shock and are protected by plated steel reflector guards, which may be rotated to direct the light. Mounting bracket is specifically designed for hanging unit in automotive-type freight cars. 35 ft of three-conductor, type ST, chrome-yellow, power-supply cord is supplied with a 3-prong, grounding-type, electrical plug. Cord is visible in the dark. Lamps guards and 14 gauge steel body are completely grounded and unit is made to JIC standards. Light is 17¾ in. in overall length and weighs 9 lbs, including cord.

Hoffman Engineering Corp., Anoka, Minn.

designed to meet severe industrial load transfer requirements . . .

FEDERAL PACIFIC'S *ALL-NEW* DOUBLE THROW SAFETY SWITCH!

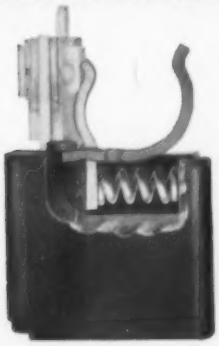
30-200 amps
Fusible and non-fusible
240 V.-600 V. AC, 250 V. DC
NEMA 1 ENCLOSURE



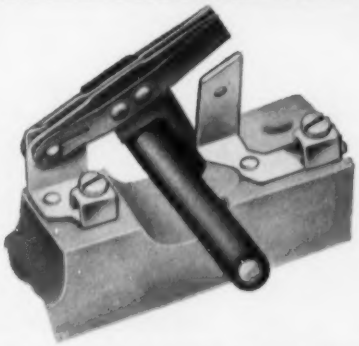
Now...a completely redesigned line of double throw safety switches! Engineered to handle load transfer from one power source to another...safely...dependably! Many of the time proven features of Federal Pacific's Heavy Duty Industrial Safety Switches have been incorporated for the most efficient operation possible. Capable of withstanding the most severe industrial applications, it is equally well suited for use as service entrance equipment. To assure maximum durability, the heavy gauge steel enclosure is anti-rust treated and finished with a tough, durable baked-on gray enamel.

PLUS ALL THESE SPECIAL FEATURES:

- QUICK MAKE-QUICK BREAK MECHANISM
- INDIVIDUAL PORCELAIN BLOCK CONSTRUCTION
- INTERLOCKING COVER
- PATENTED HIGH-PRESSURE FUSE HOLDER
- MINIMUM NUMBER OF JOINTS PER POLE.
- VISIBLE DUAL BLADE CONSTRUCTION
- FUSED BOTH TOP AND BOTTOM
- SILVER PLATED CURRENT CARRYING PARTS
- UNDERWRITERS LABORATORIES APPROVED



PATENTED HIGH-PRESSURE FUSE HOLDERS. A coil spring—located in the block beneath the fuse and unaffected by its heat—applies extraordinary leverage against the fuse and holds it in a vise-like grip. Minimizes contact resistance and resulting in cooler, more efficient switch operations.



BLADE ACTUATING MECHANISM PROVIDES DOUBLE PROTECTION. Each blade is operated by two heavy fibre blade hooks—the operating cross bar is sheathed with a thick sleeve of fibre insulation. This double insulation guarantees safety of operation.

Finest Products Engineered

FEDERAL PACIFIC ELECTRIC COMPANY

50 Paris Street • Newark 1, N. J.

NOW... *your Federal Pacific* OVER-THE-COUNTER

FEDERAL PACIFIC

Now a simple "over-the-counter" transaction solves virtually all your panelboard needs. Even complex panelboard orders can be filled INSTANTLY... RIGHT OUT OF DISTRIBUTOR'S STOCKS! And it's all made possible because Federal Pacific took the universally accepted Type AB Circuit Breakers... added stabs... and gave them "plug-in" flexibility.

The unique combination of STABREAKER flexibility and prefabricated STABREAKER panel enclosures provides the fastest method of obtaining the most flexible system of lighting and power distribution panelboards ever devised! Results: no more waiting for factory-assembled panelboards... simplified installation... big savings in time and money.

FPE
FEDERAL PACIFIC ELECTRIC

REVOLUTIONARY NEW BREAKER SLASHES SPACE AND COSTS!

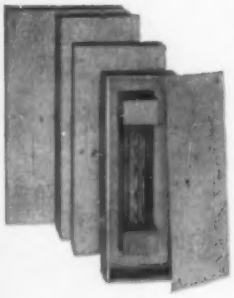
It's a big 2 for 1 story for panelboard lighting circuits... the new single-pole "NE-S" frame STABREAKER! Gives twice the number of lighting circuits in the same space occupied by conventional single pole breakers. Only 1 1/16" wide! Half the former width...less than half the former cost...without sacrifice of AB circuit breaker quality.

Finest Products Engineered

Distributor offers you PANELBOARD SERVICE *with*

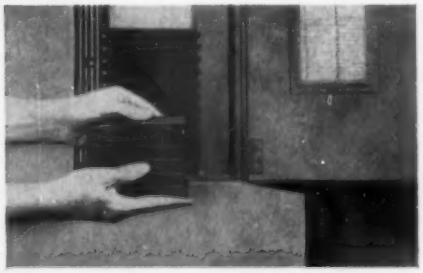
STABREAKER

HOW STABREAKER "OVER-THE-COUNTER" PANELBOARD SERVICE SAVES YOU TIME AND MONEY



1. Four different size panel assemblies are available (single and double bussing) to accommodate "NE-S", "NF-S", "NJ-S" frame STABREAKERS. Main capacities are up to 600 amps. The branch circuits required determine the size panel assembly you need.

2. Then "plug-in" the combination of ratings and frame sizes of STABREAKERS required. All standard ampere ratings through 225 amperes available.



3. When space for spare branches is needed, complete dead front is secured by means of filler plates included with each panel assembly. Merely break off required section of filler strip and slide into place. Trim holds breakers and filler strip firmly.

4. Fasten trim in place with self-indicating trim clamps and the STABREAKER Panelboard installation is complete.

STABREAKERS for AB-I Enclosures, too!

The same plug-in STABREAKERS used in STABREAKER Panelboards can be used for individually enclosed circuit breakers, too. With STABREAKER you simply "plug-in" all ratings from 15 through 225 amperes in only two NEMA-1A StAB-Inclosures. Results: unmatched flexibility and convenience . . . simple interchange of ratings . . . visible disconnect . . . simplified installation.

FPE
FEDERAL PACIFIC ELECTRIC

FEDERAL PACIFIC ELECTRIC COMPANY

Main Office: 50 Paris Street, Newark, N. J.

for unmatched AB-I

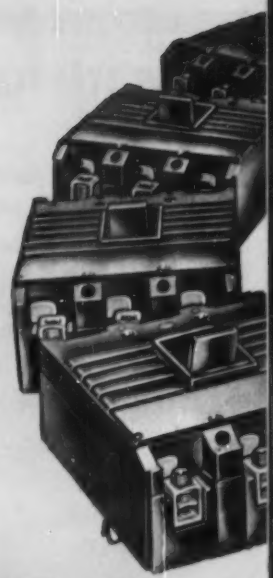
FEDERAL PACIFIC

FPE
FEDERAL PACIFIC ELECTRIC

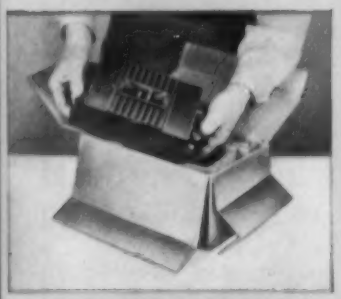
By simply adding "stabs" to Type AB molded case circuit breakers, Federal Pacific has created STABREAKER—the greatest single advance in industrial circuit breaker design in years!

Now you can plug-in any rating from 15 to 225 amperes in only two NEMA 1-A STAB-INCLOSURES! One STAB-INCLOSURE accommodates the "NE-S" and "NF-S", and the other the "NJ-S" Circuit Breakers! Two more enclosures,of the bolted type, round out the complete NEMA 1-A AB-I enclosed circuit breaker line. One for the NK, and NKL. The other for the NL.

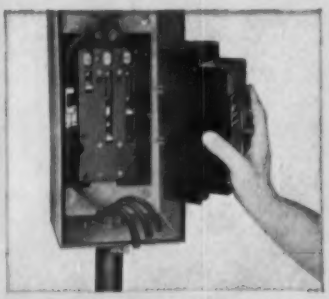
With plug-in type STABREAKERS and only two enclosures you benefit from undreamed of flexibility, convenience and savings in maintenance! Just look at some of the advantages you receive:



* *Direct from your Federal Pacific Distributors' stocks!*



INDIVIDUALLY PACKAGED STABREAKERS AND NEMA 1-A STAB-INCLOSURES. For your convenience, are separately packed...can be stored safely until ready for use.



PLUG-IN INSTALLATION. The simplest installation possible. No blind fishing for hidden screw holes because breaker automatically aligns itself when "plugged-in". Bolts through breaker front provide extra holding power. And you've got an entire boxful of space for line side wiring.

SIMPLE INTERCHANGING OF RATINGS. Nothing is easier than accommodating changes in amperage ratings. Simply pull out STABREAKER to be replaced...disconnect load side wiring. Then plug-in the new STABREAKER, reconnect load wires and it's done! No need ever to touch line leads if you have conductors of ample capacity.

Finest Products Engineered

FEDERAL PACIFIC COMPANY

Main Office: 50 Paris Street, Newark, N. J.

Plants at Newark, N. J.; Long Island City, N. Y.; Atlanta, Ga.; Cleveland, Ohio; St. Louis, Mo.; Dallas County, Texas; Scranton, Pa.; Los Angeles, Calif.; San Francisco, Calif.; Emeryville, Calif.; Affiliated plant: Toronto, Canada

flexibility . . .

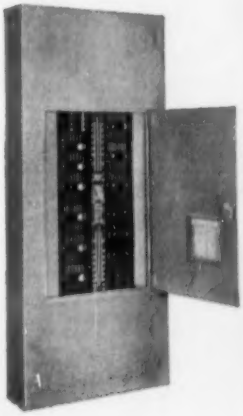
STABREAKER*

VISIBLE CERTAINTY OF BREAKER DISCONNECT. STABREAKER with its unique feature of VISIBLE DISCONNECT overcomes the reluctance of safety engineers to circuit breakers. Absolute safety is insured because you *see* the break! Just pull out the STABREAKER and let it hang by load wires.

ELECTRIC

STABREAKER FOR PANELBOARDS TOO!

The same plug-in STABREAKERS are also the answer to your panelboard problems. With four basic enclosures and a complete range of STABREAKERS up to 225 amp. including the 11/16" single-pole STABREAKER, you can now get instant over-the-counter delivery of lighting and power distribution panelboards! You save delivery time! You save money! You save installation time!



FPE
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Now! Wire Nuts

THE SOLDERLESS, TAPELESS WIRE CONNECTORS
(Patent No. 1,933,356)

are UL approved for 600-V. use

Ideal's No. 74-B and No. 76-B Wire Nut Connectors are fully approved for 600 Volt use as pressure cable connectors. They comply with Section 1118, National Electrical Code, and can be used for branch circuit wiring as well as fixture hanging.

and only IDEAL makes Wire Nuts

"Wire Nuts" is a registered trade name of the original screw-on wire connector developed and manufactured by Ideal Industries, Inc. Wire Nuts have an unmatched record for performance and safety for over 30 years. Don't settle for less than the best—specify IDEAL!

SCREW-ON Wire Nuts FOR QUICK, EASY, LOW COST SPLICES ON EVERY WIRING JOB

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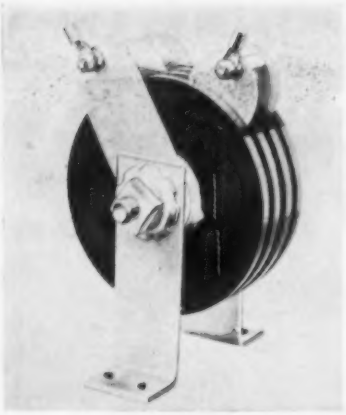


Discharge Varistor Assembly (19)

A new Thyrite discharge varistor assembly which represents the first commercial offering of a voltage sensitive nonlinear resistor of its type—suitably mounted for direct installation in electrical circuits. It is designed for use in protecting motors, generators, lifting magnets, magnetic chucks, solenoids, relays, large coils etc., against high inductive surges resulting from sudden interruption of inductive currents. Referred to as type 9RV6A assemblies, the new resistors are manufactured in ready-mounted groups of 1 to 4 varistors. Each varistor disk is 6 in. in diameter and $\frac{3}{4}$ in. thick, with a 1-in. central mounting hole. Disks are bracket-mounted on a horizontal insulated bolt with a spring lock washer to provide contact pressure. Spacers are included to permit air circulation.

General Electric's Metallurgical Products Dept., Detroit 32, Mich.

Fire Alarm System (20)

An approved fire alarm system designed for small buildings and schools, that is suitable for use with manual or automatic alarm stations. System provides a continuous coded alarm until manual or automatic alarm stations are restored to normal condition. Operation of any alarm station actuates a motor-driven code mechanism for continuous transmission of predetermined alarm signals through all warning devices. Chimes, single stroke bells or horns can be used. They should be readily distinguished from normal paging or programming signals. Manual alarm stations are designed to harmonize with most modern structures. Mounting can be made on standard 4-in. or $4\frac{11}{16}$-in. square boxes with single gang plaster cover. Overall depth of die-cast housing is 1-in. Automatic detectors mounted on ceiling are combination fixed temperature and rate-of-rise type thermostats rated at 136°F and 190°F for ambient conditions at installation point. Fire alarm system is supervised through a control panel that contains a Telechron master coding

Another **TRIANGLE** *multiple product Job*

PALM BEACH

Palm Beach Towers. Florida's Largest Apartment Hotel

...designed for luxurious year-round apartment living:

1,100,000' of TRIANGLE WIRE and CABLE
169,000' of TRIANGLE CONDUIT
52,000' of TRIANGLE COPPER TUBE

Luxury *demands* Quality. That's why Triangle conduit, wire, cable and copper tube were specified for the job.

Triangle is famous for the finest quality building products that research and modern equipment can produce.

Triangle products are nationally distributed—representatives are located in principal cities in the United States. For your next installation, you'll find it pays to call Triangle!

Palm Beach Towers, scheduled for opening December 1, 1956, is completely air conditioned, with restaurants and specialty shops provided to make it one of America's finest resort hotels.

ARCHITECT: John Hans Graham
GENERAL CONTRACTOR: The Taylor Construction Co.
ELECTRICAL CONTRACTOR: Interstate Electrical Co.
PLUMBING CONTRACTOR: Clarence Coston

let's take a quick look at **TRIANGLE**

Up to date research

Ever expanding plants

Large stocks in redistribution centers

The Triangle Trademark is your guarantee of quality

It Must Be Right
The Trade Mark of TOP Quality
TRIANGLE

TRIANGLE

Conduit and Cable Co., Inc.

NEW BRUNSWICK, NEW JERSEY

BETTER LOOKING . . .

ELECTRICAL RIGID CONDUIT, made by Alcoa, is the kind to use where good appearance of the installation is important . . . as in beverage plants, food processing plants, laboratories.

And the good looks of conduit made from Alcoa® Aluminum are *permanent*.

It fights rust and corrosion. There's no coating to stain, peel or blister. It rarely needs painting.

It's light, strong, easy to handle and install.

It has Underwriters' Laboratories approval . . . it's nonsparking and nonmagnetic. You can use it for hazardous locations . . . for separating conductors, regardless of load. It permits longer runs, or can save on wiring costs (because there is less voltage drop, smaller wires can be used).

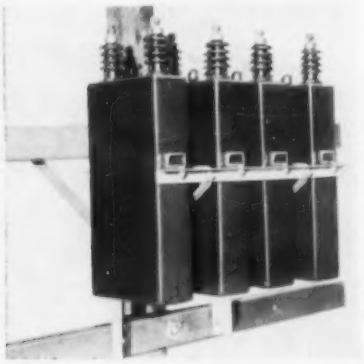
Check on the advantages of rigid electrical conduit made by Alcoa. Contact any Alcoa sales office, or write Aluminum Company of America, 2327-L Alcoa Building, Pittsburgh 19, Pennsylvania.

Your Guide to the Best in Aluminum Value

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

device, a milliammeter, time limit cut-out, fuses, control relays, resistors and terminals. A trouble bell is supplied for warning when circuits are accidentally opened or grounded. Control panel is mounted in a steel enclosure, finished in bright red, for operation from any 115-230-volt, 60-cycle, 3-wire source. Listed by U. L.

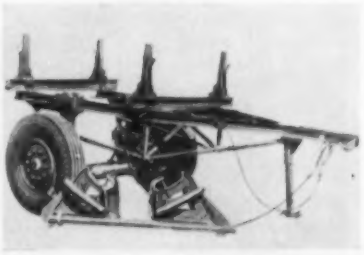
Edwards Company, Inc., Norwalk, Conn.



Hanger (21)

A new NEMA standard 4-unit capacitor hanger, which meets the demand for a sturdier hanger that will have the structural strength to support four 50-kvar units. Made of heavy hot-dip galvanized steel, it provides interchangeable mounting for three or four 15-, 25-, and 50-kvar units. All necessary parts—plus a ground connector—and an exploded assembly diagram are included with each capacitor hanger.

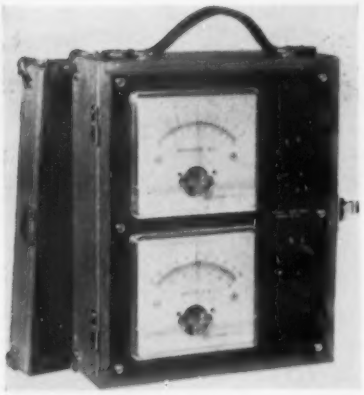
Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.



Trailer (22)

A combination cable reel and pole trailer has been added to this line. Trailer can be equipped for transporting cable reels using standard reel saddles and guides. For carrying poles or general cargo, interchangeable bolsters are also provided. Quick conversion from bolsters to reel saddles can be made in field using standard hand tools. Two models are available, both rated 8,000 lbs. capacity; one built for 34-in. to 38-in. wide reels, the other for 44-in. to 48-in. wide reels.

The Adams Engineering Co., Solon Road, Solon, Ohio.



Instrument **(23)**

Dual electrolysis voltmeter — one meter with ranges of 2.5-5-10-50-100-500 millivolts at 2000 ohms per volt and one meter .3-1-3-10-30-100-300 volts at 50,000 ohms per volt. Both meters center zero. Eliminates push-buttons and switching for changes in polarity and two simultaneous readings, accuracy 1%. Clear plastic cased meters. High sensitivity voltmeter eliminates need for potentiometer to read true open circuit voltages in most cases. Bulletin is available.

Stewart Brothers, Division of Instrument Laboratories, 315 W. Walton Place, Chicago 10, Ill.

Time Delay Relays **(24)**

For time delay applications requiring frequent time adjustments a new line of dial head AGASTAT time delay relays have been developed. Dial markings permit easy calibration for accurate adjustment and each dial is color coded to identify the timing range. There are four timing ranges available in the dial head model. They are for time periods from $\frac{1}{10}$ second to 3 seconds; $\frac{1}{10}$ to 10 seconds; 10 seconds to 2 minutes; and 30 seconds to 15 minutes. Each unit is adjustable within these timing ranges. New dial head models consist of a pneumatic timing head, a solenoid assembly, a switch, a coil and terminals. They can be supplied for continuous ac duty and for continuous or intermittent dc service. They are available for ac opera-

Stuck Valves
Hard-to-Heat Spots
Frozen Pipes
Sluggish Materials
Underheated Rooms

Do something about it NOW!

This FREE book tells you how

Here's brand new application information on hundreds of uses of Chromalox Electric Heating Equipment for winter weather problems. These factual reports provide you with a rich source of ideas tailored strictly to winter heating problems in and around the plant and office.

Whether it's room heating, deicing, snow melting, warming of materials, or any of a hundred winter heating jobs, this exclusive information will show you how to solve the problem the electrical way.

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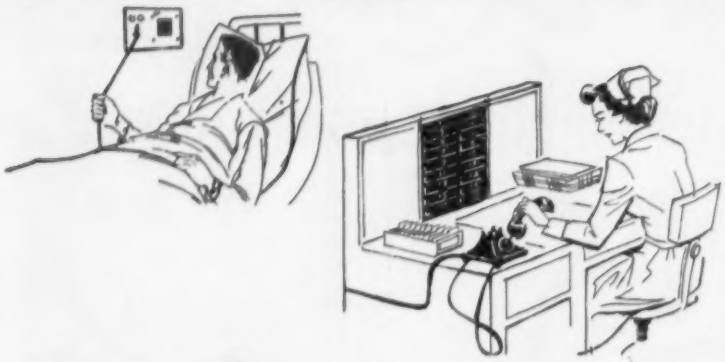
. . . the expression

"or equal"

is your opportunity to BUY THE BEST . . . a Couch AUTOMATIC NURSE CALL system



here's 3 good reasons why:

1 competitive price . . .

2 easy installation and maintenance . . .

3 plug-in electrical components . . .

write for bulletin 126

. . . other bulletins

Hospital Signalling	— bulletin #125
Private Telephone Systems	— bulletin #121
Apartment House Phones	— bulletin #128
Fire Alarm Systems	— bulletin #124

S. H. Couch Company, Inc.
North Quincy, Mass.

Built-in Dependability

tion at all standard voltages from 6 to 550 volts, 60 cycles and 25 cycles. For dc operation, they are made for all standard voltages from 6 to 230 volts.

Elastic Stop Nut Corporation of America, Elizabeth, N. J.

Switch (25)

A new, high voltage, air interrupter switch functions as an air break disconnect with continuous and interrupting ratings to 600 amps at 15 kv. Designed to be safely opened under load, it will interrupt all currents to its continuous rating. Three front-operated 3-pole types are available: single throw, non-fused, wall-mounted; single throw, fusible, free-standing; double throw, fused or non-fused, free-standing. Units are easily installed, indoors or outdoors—free standing, wall-mounted, transformer throat connected, etc. Cubicles may be supplied of either steel or aluminum. Combined with power fuses, high voltage air interrupter switches offer full circuit protection where automatic restoration of service is not required. Power fuses are accessible by two specially hinged doors on free standing units. Doors are interlocked so that they may be opened only when switch is in "Off" position.

Continental Electric Equipment Co., 205 West 4th St., Cincinnati 2, Ohio.

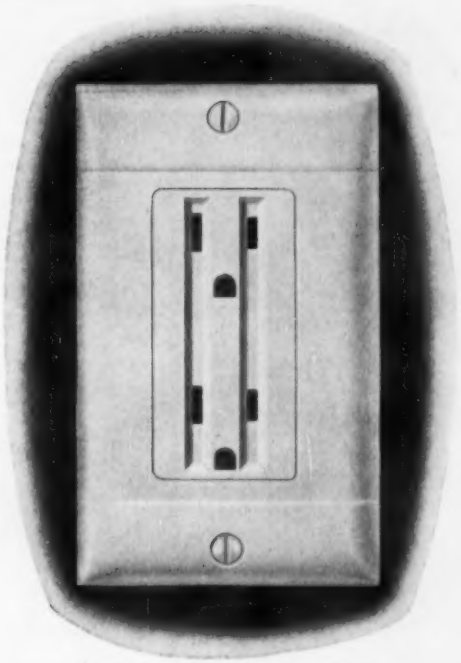
Clip (26)

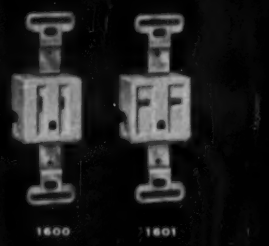
A new ceiling clip and special guard combination designed to provide powder-actuated stud driver users with a fast, inexpensive method to fasten suspended loads, grids, or structures. Clip is inserted directly into the guard and the stud is driven through the clip into the base surface. Studs designed for steel or concrete applications are available, and the clip itself is a sturdy angle bracket made of 14 gauge steel, zinc plate with a $\frac{7}{16}$-in. hole in one leg.

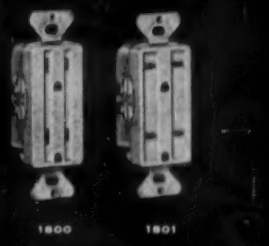
Remington Arms Company, Inc., Bridgeport, Conn.

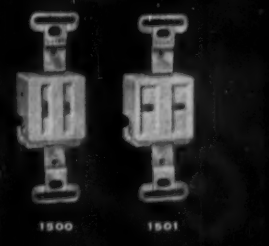
the look of **tomorrow**—engineered by Sierra **today!**

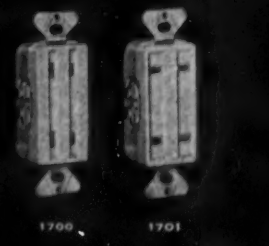
SIERRAPLEX RECEPTACLES











A new concept in wiring devices. Made only in Specification Grade, these receptacles with their clean, contemporary style will add to your prestige with architect and builder . . . for the SIERRAPLEX design shows instantly that you have installed the finest on the market today. Full line: Single and Duplex in Tandem or Parallel slots; both grounding-type and two-wire. Each is complemented with a distinctive Sierra wall plate. Installation is quick and easy. Consistent quality eliminates costly call backs. Write for Catalog.

SIERRA ELECTRIC CORPORATION

15100 SOUTH FIGUEROA, P. O. BOX 85

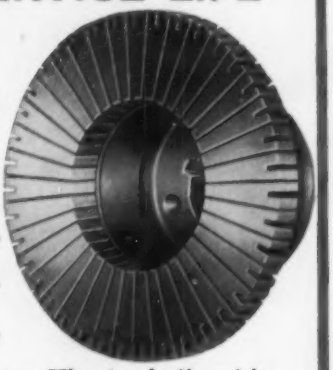
GARDENA / CALIFORNIA

...here's a tip for **MOTOR REPAIR MEN** from GENUINE JOE

GENUINE

Wagner

COMMUTATORS ARE BUILT WITH EXTRA STRENGTH FOR LONGER SERVICE LIFE



Wagner Commutators . . . "proved best by high speed test"—that's a point to remember when you replace a worn commutator. Choose a *genuine* Wagner replacement. Wagner Commutators are designed to withstand great centrifugal force. They're built with care for longer service life. They're safe to reface, too.

THESE FEATURES MAKE THE DIFFERENCE:

1. Mica washer insulates commutator from the short-circuiting ring.
2. Short-circuiting ring is made of brass.
3. Bakelite washer insulates short-circuiting ring from commutator hub to eliminate harmful shaft currents.
4. Reinforcing steel shell.
5. Entire assembly molded in high impact phenolic compound.

It's wise to stock Wagner Replacement Motors

Smart motor repairmen always carry a stock of Wagner Replacement Motors. They come in handy for emergency use when your customer needs immediate service and they're easy to sell as replacements for motors "too far gone" for repairs. You can get an attractive motor display rack for only $9.95 with the purchase of ten or more Wagner Motors. Check into this deal today.

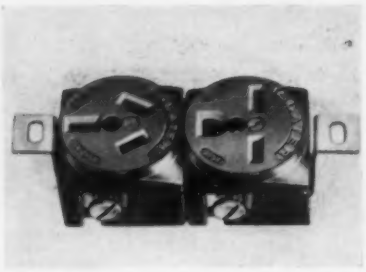
WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U. S. A.

Wagner Electric Corporation EST 1891

MOTORS · BEARINGS · STANDARD ROTORS
BRUSHES · CAPACITORS · COMMUTATORS

OVER 850 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

MS56-7



Receptacle **(27)**

A new 2-circuit duplex grounding receptacle, No. 394, for air conditioners, combines the tandem and 3-wire, 20-amp crow-foot style face on one receptacle. It is especially good for use in new construction work where provisions for air conditioning units are made. It has two separate circuits, one 15-amp 250 volts, the other 20-amp 250 volts. A ground terminal is connected to the strap so that in metallic wired systems there is no need for a ground wire. Can be back wired or side wired.

Slater Electric & Mfg. Co., Inc., Woodside, L. I., N. Y.

Intercom System **(28)**

Automatic voice control that does away with need for manually operating any controls during conversation, yet permits private and selective communication, is featured in the new Super Chief Automation Series 7700 Talk-A-Phone. "Built-in Automation" provides for automatic voice control, automatic traffic control, and automatic monitoring signal, as well as closed circuit conferences—all automatically. Series 7600, a companion model, features automatic touch control as well as automatic traffic control and closed circuit conferences. Both series 7700 voice controlled and Series 7600 touch controlled units can be intermixed. With automatic voice control, the voice automatically operates the talk-listen control for you, even when conversing with touch controlled units. Automatic traffic control determines and controls the traffic on the line with visual signals: green for a clear line, red when a line is busy, and amber when a line is being called. Dynasonic design; Multi-Magic selector and Uni-Trans are included in the new Super Chief series.

Talk-A-Phone Co., 1512 So. Pulaski Rd., Chicago, Ill.

Today's Higher RLM Specifications make the RLM LABEL for INDUSTRIAL LIGHTING UNITS More Significant than ever before!

...More Significant than ever

because Today's RLM Specs assure even higher Operating Efficiency, Better Performance and Longer Life:

- Higher light output
- More seeing comfort
- Better protection against glare
- Increased brightness control
- Greater reduction of light loss
- Lower-cost installation
- Easier relamping
- Greater safety from electrical hazards
- Greater protection against corrosion

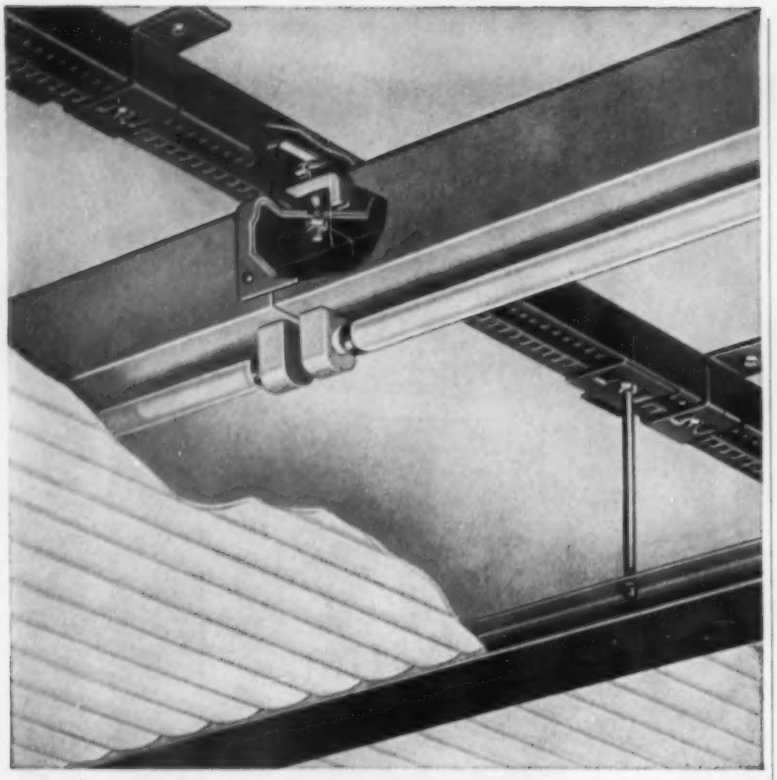
R-1028

The RLM Label affixed to a lighting unit is a Certificate of Assurance. It assures the buyer that the equipment meets or exceeds important quality standards established by the RLM Standards Institute. As shown by the partial list of user benefits at left, these higher standards make the RLM Label more significant to everyone who buys, sells or specifies industrial lighting equipment.

You can rely on this warranty. It is upheld by the extensive RLM Inspection and Certification Program—the real backbone of the RLM Label. Periodic inspections are made by an independent laboratory. Lighting units are checked for conformance to RLM Standards as they come off assembly lines and at all levels of distribution.

This latest edition RLM Specification Book will acquaint you with the full significance of the RLM Label today. Your copy is available without cost or obligation from: RLM Standards Institute, Suite 819, 326 West Madison Street, Chicago 6, Illinois.

RLM STANDARDS INSTITUTE
INCORPORATED



Mult-A-Frame It!

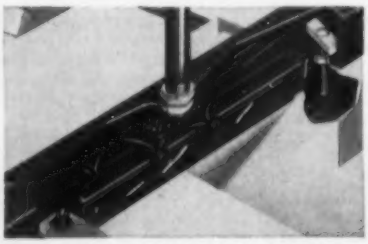
The quick and easy way to install luminous ceilings in any building

HERE'S HOW YOU DO IT: attach MULT-A-FRAME directly to present ceiling with standard suspension brackets. T-bolt-clamp fluorescent fixture to channel. Drop hanger rods from same channel. Drill through top of aluminum track and attach hanger rod with standard hexagonal nut. Lay in plastic ceiling and the job is done.

IT'S QUICK, EASY, ECONOMICAL: only tools required are a saw, drill and wrench. No skilled labor is needed and installation takes less time than with special materials. The result: a double saving—in man hours and cost per hour.

LIKE TO KNOW MORE: simply write today for your free copy of the complete MULT-A-FRAME story told in the illustrated brochure, "Hold Everything." You can actually install a luminous ceiling at lower cost than a conventional one.

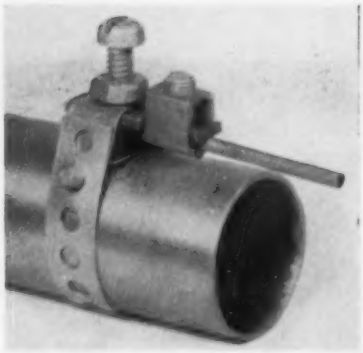
See our catalog in SWEET'S 6-2



Use MULT-A-FRAME as a raceway. Closure strips and end caps are available that snap into position at the pressure of your fingers.

MULT-A-FRAME

MULT-A-FRAME DIVISION
Ainsworth Manufacturing Corporation
1471 E. Atwater St., Detroit 7, Mich.



Ground Clamp (29)

A new adjustable ground clamp designated Part T-1-SL, incorporates the company's "Original Adjustable Idea". Clamp consists of a ⅜-in. wide tinned, pure copper perforated strap to which a tang is soldered holding a connector to accommodate No. 14 to No. 4 wire. The clamp is adjustable to fit ¾-in. to 1¼-in. steel pipe or ¾-in. to 1⅛-in. O.D. copper pipe. The exclusive "Original Adjustable Idea" intermediate-tightening screw draws up slack to contract the band around the pipe. A "shield" rests between the end of the tightening screw and pipe.

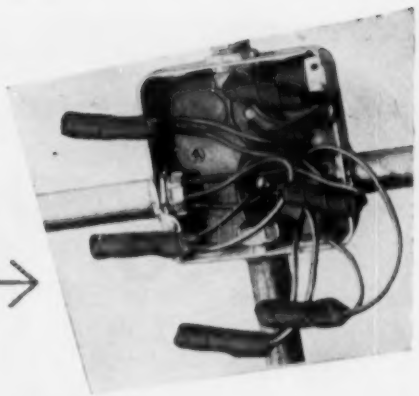
Blaco Manufacturing Co., 6541 Euclid Ave., Cleveland 3, Ohio.

Cable Reel Jack (30)

Constructed of welded steel sections, this redesigned reel jack is ratchet-operated and designed expressly for cable reels. Base sections are of 4 in, 5.4 lb. channel with side and back legs of ¾-in. by 1¾-in. steel. Base measures 24 in. across and 14 in. in width to give maximum support in both directions. Swivel yoke ranges in height from 27¾ in. to 45½ in. The wrought steel square thread has a diameter of 2 in. and is 21 in. long. Cable reel jack will accommodate up to 2½-in. spindles and has a capacity of 10 tons. Each pair of jacks weighs 130 lbs.

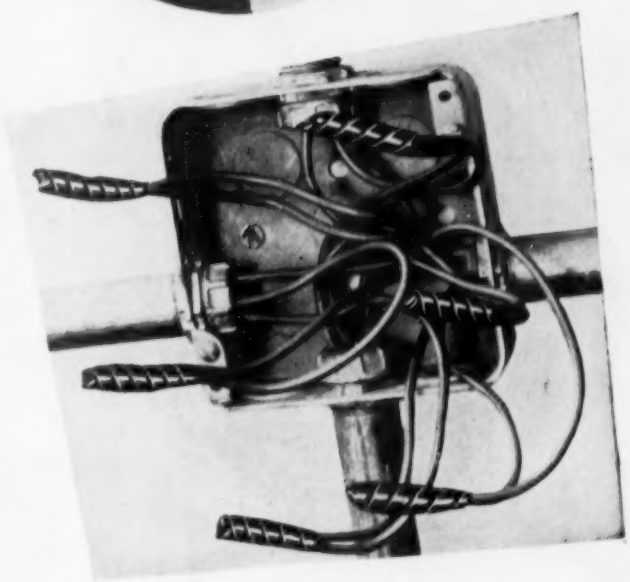
T. J. Cope, Inc., 3rd Ave. & Walnut Sts., Collegeville, Pa.

Avoid this



use this

for results like this . . .



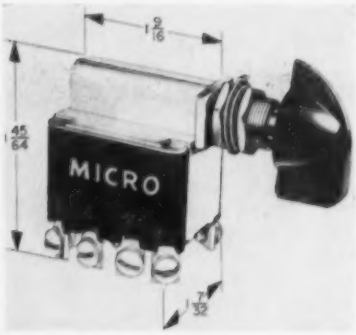
For neat, sure insulation without bulk, use Porter vinyl electrical tape. One operation does the job. No outer wrapping needed. Dielectric strength stands up to high voltages. Resistant to acids, water, corrosion. Conforms readily to curves. Retains adhesion under toughest service conditions. Ideal for production line and maintenance work. Order from your Quaker distributor.

Porter Vinyl Electrical Tape carries Underwriters' Laboratories Inc. seal

H. K. PORTER COMPANY, INC.

HKP QUAKER RUBBER DIVISION
PHILADELPHIA 24, PA.
QUAKER PIONEER RUBBER DIVISION
PITTSBURG, CALIF.

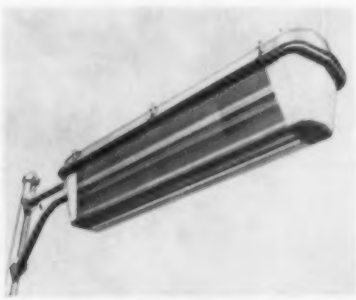
UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free.
COPR. 1937
THE RIDGE TOOL CO.
ELYRIA, O.
RIGID HEAVY DUTY 14
14
there's Only one



Toggle Switch **(31)**

A new rotary toggle switch can handle a high electrical load and is rugged enough for most industrial and airborne applications, having successfully passed impact, shock, acceleration and vibration tests. The 4-pole, double-throw switch (designated 4TRI) is maintained in all three actuation positions: on-off-on. It has 12 terminals. Other models are available with up to 24 terminals (8 poles). Switch has an operating force of 9-in. pounds max. Electrical rating is: continuous capacity of 30 volts dc; 20 amps resistive; 5-amp lamp or 12 amps inductive. At 115 volts, ac, 20-amp resistive; 4-amp lamp and 15 amps inductive.

MicroSwitch, Freeport, Ill.

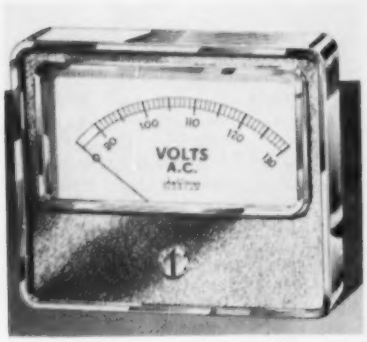


Fluorescent Luminaire **(32)**

A new line of L-M fluorescent luminaires is designed to accommodate present standard or future VHO (very high output) lamps of 4- or 6-ft lengths. Unit is available with either deep or shallow Plexiglas globes, retains the high optical efficiency of original units. Luminaires incorporate several features that facilitate installation and enable servicing without tools. The globe is securely latched on each side, and it hinges safely from either side of the aluminum cover to allow fast, easy clamping. The Alzak aluminum reflector and lamp assembly also hinges to provide ready accessibility to the two internally housed ballasts and wiring. Pressure-pad input terminals are tin plated to accommodate either copper or aluminum conductors, and friction type connectors are provided on all internal leads. Other features include slipfitter mounting with a plus or

minus of 4° leveling device. Spring-loaded lampholders for recessed base lamps, provision for connection on 2- or 3-wire systems, and protection from weather and insects.

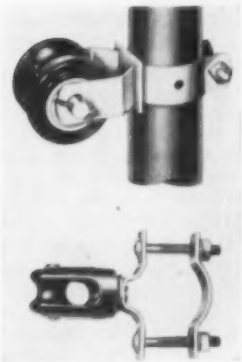
Line Material Co., 700 W. Michigan St., Milwaukee 1, Wis.



Instrument **(33)**

A new line of expanded scale voltmeters, either ac or dc, and in a wide variety of ranges and case styles for specified requirements. The ac movements have wide frequency ranges, good linearity and true RMS readings. The illustrated custom panel meter with expanded scale 90 to 130-volt ac RMS was designed for line voltage measurements and is available in nine case styles. The section of the scale needed most has been expanded and that section under 90 volts, has been greatly reduced.

Phaostron Instrument and Electronic Co., 151 Pasadena Ave., South Pasadena, Calif.



Service Deadends **(24)**

Two new service entrance brackets, designed for ranch type houses. Brackets clamp securely to the service entrance conduit and provide a sturdy, inexpensive method for deadending service drops. The wireholder type deadend accommodates standard service wires and can be mounted on rigid conduit of 1¼ through 2½ in. IPS. All metallic parts are galvanized steel, except a spun copper rivet fastening

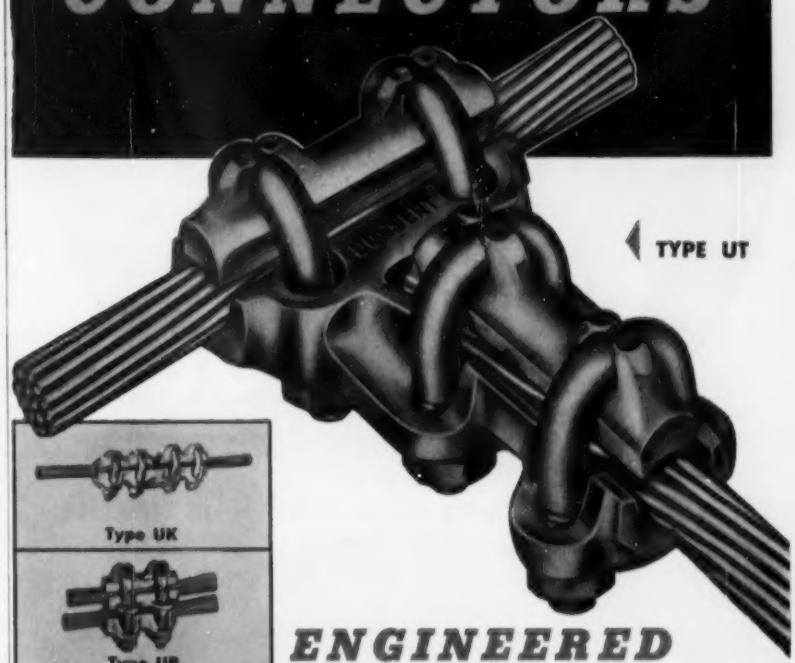
Fast to make fast!

Safe, swift cable connections with

DOSSERT

U-BOLT

CONNECTORS



Type UK

Type UP

Type UPK

Type UL

Type UPT

Type US

ENGINEERED FEATURES:

VARIABILITY

Fits many cable sizes, reduces number of connectors needed for given number of combinations of conductors.

HIGH CLAMPING ACTION

U-Bolts clear all conductors by close limits, supported by saddles through their full arcs. Minimizes bending action, makes U-Bolts subject to tensile stress only.

CABLE END RELIEF

Allows for distortion in free ends of strands, ample room for binding end of stranded cable if desired.

CONDUCTIVITY

High copper alloy with sufficient contact area to insure cooler-than-conductor operation under maximum load.

50 YEARS OF TECHNICAL KNOW-HOW

Representatives in all principal cities.
IN CANADA: W. B. Gerrie & Assoc., Ltd., Toronto

WRITE FOR DETAILS AND PRICES TODAY!

DOSSERT MFG. CORP.

249 Huron Street, Booklyn 22, N. Y.

BIG CABLES

BRONCO 66

TYPES W & G

NOW BEING MADE IN SIZES BIGGER THAN 1¾" IN DIAMETER

Write for new FREE catalog:

WESTERN INSULATED WIRE COMPANY

Los Angeles 58, California

the insulator to its supporting strap. The spool type deadend, consisting of a clevis and spool insulator, provides a large radius for heavy conductors. It can be mounted on 2- or 2½-in. rigid conduit. Except for a self-locking brass cotter key, all parts are galvanized steel.

Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.

Product Briefs

(35) Many of the critical heat detection and measurement problems associated with nuclear reactors and components may be solved through a new heat-sensing **instrument**, Evaporograph, manufactured by Baird Associates-Atomic Instrument Co., Cambridge, Mass. . . . (36) The PBR Manufacturing Co., Philadelphia, Pa., has developed a new and improved scope **dolly**. . . . (37) Fenway Machine Company, Philadelphia, Pa., has introduced a newly developed portable metal **cutting nibbler** for cutting 16 gauge corrugated sheet metal.

(38) General Electric Co., Schenectady, N. Y., has announced a new mechanical **pressure relief device** is being supplied on all of the company's large power transformers that use an automatic gas-seal, gas-oil-seal, or sealed tank type of oil preservation system.

(39) **Brushes** especially processed to meet the operating requirements of silicone insulated machines have been introduced by National Carbon Co., New York, N. Y. . . . (40) Manufacturing plants and refineries now can be equipped with **remote control** devices that measure the level in storage tanks and bins located more than three quarters of a mile away. They are manufactured by the Fielden Instrument Division, Robertshaw-Fulton Controls Company, Philadelphia, Pa.

. . . (41) Aircraft-Marine Products, Inc., Harrisburg, Pa., has introduced a newly designed **Termalum terminal** for aluminum wire terminating.

(42) **Self-sticking** wiring diagrams, instruction sheets, repair parts list come mounted on handy zip-off liners or fast-to-dispense rolls. Manufactured by W. H. Brady Co., Milwaukee, Wis.

. . . (43) A completely automatic, self contained **conveyor unit**, Lanceveyor, is set into the user's present system and by means of an automatic control circuit may be extended through dock door onto trucks, permitting direct handling to or from the truck. It is manufactured by Lance Iron Works, Chicago Heights, Ill. . . . (44) General Electric Co., Syracuse, N. Y., has introduced a new 450-megacycle **two-way radio** unit which will be included as a standard item in the company's interchangeable Progress line.

(45) Anthony Co., Streator, Ill., has introduced a new lighter weight **lift gate** model for larger trucks handling light, bulky loads.

ANY OF THESE LEFT IN YOUR PLANT?

The green eye shade . . . it used to be standard equipment for the skilled machinist, toolmaker and precision assembler. It was his sole defense against the painful glare conditions found throughout industry until a very few years ago . . . and still found in an alarming number of plants even today.

Wonderful things happen when the need for the green eye shade is eliminated by modern lighting planned to give good "seeing"—for greater efficiency, accuracy and comfort. Case after case proves that production goes up, rejects go down, absenteeism and industrial accidents are greatly reduced.

Quality industrial lighting . . . and re-lighting . . . very quickly pays for itself. May we demonstrate the facts? Call in your electrical contractor and your Miller representative!

MILLER RLM INDUSTRIALS

Miller industrials, "Crown" and "Imperial", meet and exceed the newest standards for quality plant lighting. They provide greater light output, increased upward light, better shielding, more efficient reflection factors. Improved structural details mean longer life, lower maintenance and quicker installation. Write for bulletin.

miller
SINCE 1885

Better Lighting for a Brighter America

THE MILLER COMPANY • GENERAL OFFICES: MERIDEN, CONN. • FACTORIES: UTICA, OHIO and MERIDEN, CONN. • IN CANADA: CURTIS LIGHTING OF CANADA LTD., TORONTO

SEE US AT BOOTH #1626, 8TH NATIONAL MAINTENANCE & ENGINEERING SHOW

EVERY TIME

You Thread Pipe . .

. . . you'll appreciate this popular TOLEDO trio. Pick up the rugged, dependable TOLEDO small ratchet Pipe Threader. Pull the pawl—drop in a die—you're ready to thread in seconds. You'll like the easier handling, better grip, the famous TOLEDO quality. (⅛ to 2" sizes.) Then,

FOR QUICK CUT-OFF . .

. . . pick up a TOLEDO No. 20 Pipe Cutter, a wheel and roller combination that can't be equalled for fast, accurate cutting. Frame fits the hand for easy, natural grip. Cutter leaves little or no burr. Handles easier to save you time and effort. (Capacity ⅛ to 2".) Then,

FOR MAXIMUM PRODUCTION . . .

. . . put the lightweight No. 88 Power Vise on the job. Powerful, efficient, the No. 88 features the exclusive Spin-Torque Chuck for easy opening and closing. Mounts on bench, service truck or on legs with tray. Choose TOLEDO quality pipe tools for unmatched satisfaction. You'll thank your lucky stars you did!

THE TOLEDO PIPE THREADING MACHINE CO.
TOLEDO 4, OHIO

BUILDERS OF THE WORLD'S FINEST PIPE TOOLS

TOLEDO®

PIPE THREADERS • PIPE WRENCHES • PIPE MACHINES

CATALOGS and BULLETINS

(46) FLUORESCENT LUMINAIRES for industrial applications are detailed in 36-page Bulletin B. Data is included on 25% upward component units, 800ma lamp units and special location fixtures. Listings cover 394 industrial units. Benjamin Electric Mfg. Co.

(47) POWER TRANSMISSION MACHINERY such as drives, couplings, reducers are listed in pocket-size manual covering dimensions and specifications of the complete line of transmission elements. Catalog D56, 328 pages. Dodge Mfg. Corp.

(48) WIRING DEVICES and enclosed switches are described in revised Catalog 29. Featured items are Quiette line of switches and grounding type receptacles and caps for 20-amp, 125- and 277-volt applications. Arrow-Hart & Hegeman Electric Co.

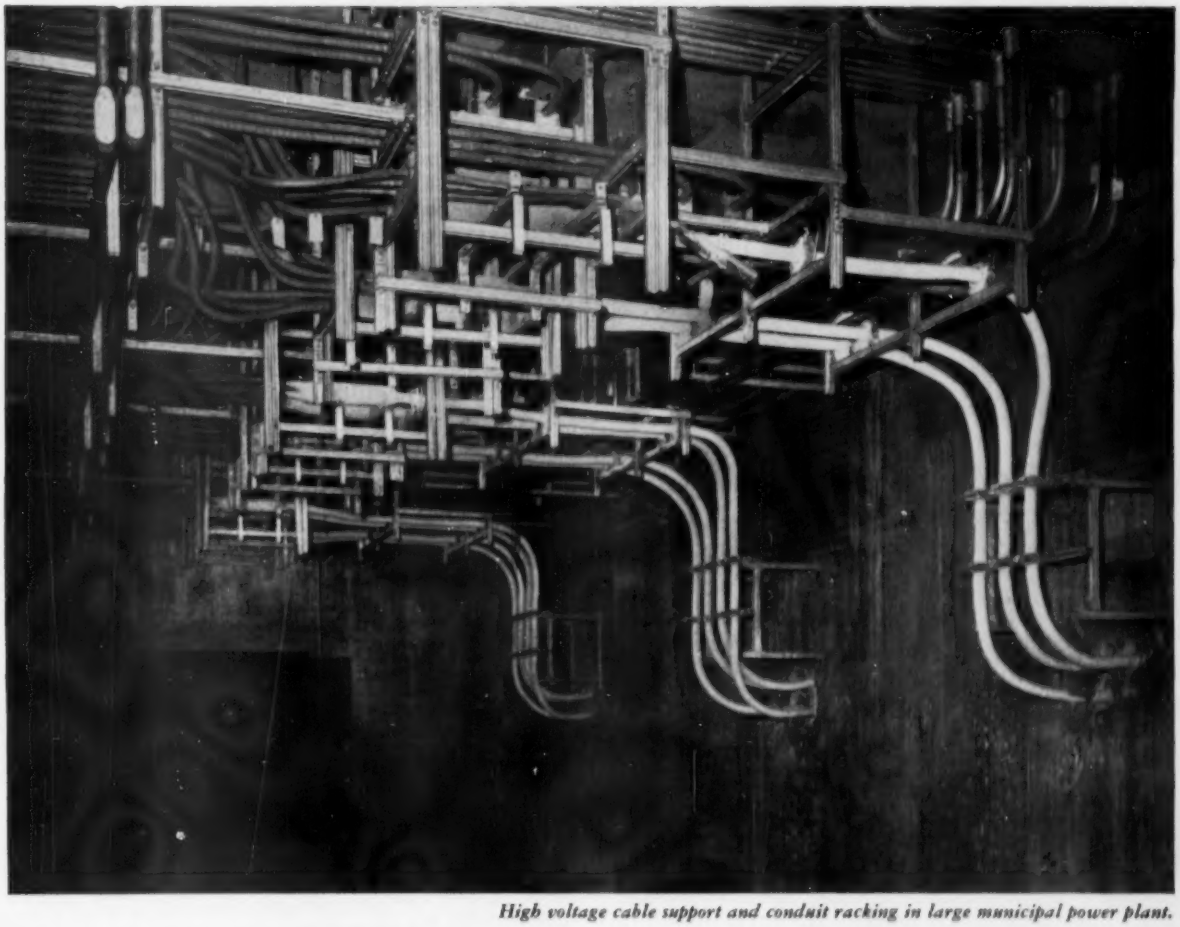
(49) EXPANSION SHELLS are a combination of masonry drill and concrete anchor. Bulldog shells are available in sizes from ½- to ¾-in. J. D. Polis Mfg. Co.

(50) CIRCUIT BREAKERS. Three bulletins. Interrupting rating of 100,000 rms amps on 250-volt dc and 600-volt ac units in continuous ratings from 15 to 600 amps are afforded by new molded-case Cordon breakers described in Bulletin 5042. FB line of high-speed, current-limiting dc breakers rated at 1200-5000 amps, 1000 volts are the subject of 6-page 3004-A. Bulletin 1004-A, 6 pages, gives characteristics of the K line of breakers and information on heavy-duty dc units. I-T-E Circuit Breaker Co.

(51) LIGHTING. Complete line of commercial and residential fixtures and portable lamps are illustrated in File-Folder featuring Finnish and Swedish designs. EJS Lighting Corp.

(52) CONNECTORS AND ANCHORS are among the four hundred items listed in the new Hi-Catalog 12. Other devices include fish tapes, clamps, and fuse accessories. Holub Industries, Inc.

(53) BATTERY CHARGER, designated the Phano-charger, is de-



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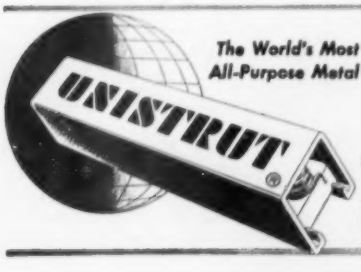

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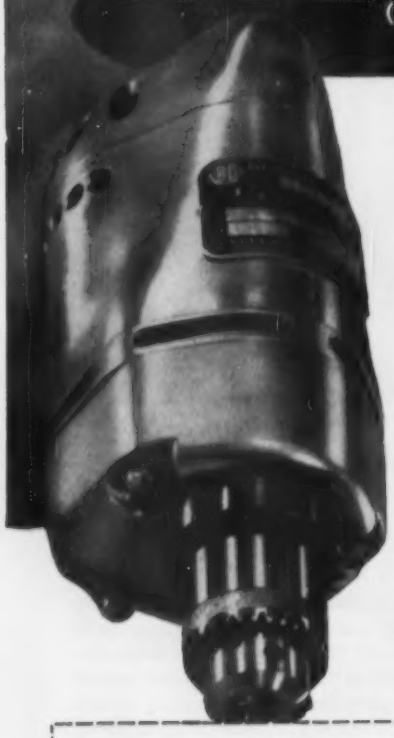

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tailed in 4-page Bulletin GEA-3179D. Design and performance benefits include automatic self-regulation, no voltage drift and low maintenance. General Electric Co.

(54) DRYING CHEMICAL for displacing water from wet motors or other electrical equipment is named Spraydri. Folder A10, 4 pages, gives applications and directions for use of Spraydri Aerosol bombs. Spraydri Co.

(55) ELECTRICAL TAPES. Catalog 8101-E305, 4 pages, describes available sizes and packaging of Bull Dog friction, rubber tapes. Features of tapes are high strength and ease of handling in splicing. Boston Woven Hose & Rubber Co.

(56) MOTORS. Three 6-page folders have drawings of design features with dimension tables and hp-frame charts. Bulletins are: 51B6210G—Open motors, ½- to 100-hp; 51B7225D—Totally enclosed, fan-cooled motors to 100 hp; and 51B7286G—explosion-proof motors, also to 100 hp. Allis-Chalmers Mfg. Co.

(57) SERVICE STATION LIGHTING equipment is described in 6-page Form 1082. Rapid-start and slimline island units for davit or straight pole mounting feature all-aluminum chassis and 60% more light emitting area. Floods, poles, Steberlites and fittings also listed. Steber Mfg. Co.

(58) TIME SWITCH permits use of many varied on-off schedules during a 24-hour period. Minimum on-time can be 15 minutes; minimum on-off cycle is 45 minutes. Ratings are 120, 240 or 480 volts. Easily rescheduled in the field. Bulletin GEC-1406. General Electric Co.

(59) HV SWITCH for variety of mounting conditions functions as air break disconnect with continuous and interrupting ratings to 600 amps at 15 kv. Moderate cost unit available as single- or double-throw fused or non-fused. Bulletin 100 gives structural details of free-standing, wall-mounted and transformer-throat-connected switchgear units. Continental Electric Equipt. Co.

(60) CARBON BRUSHES and commutator maintenance are discussed in 27-page Booklet B-6150-A. Subjects covered include: maintenance requirements; factors affecting

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ROEBLING ROEPRENE TYPE RHW, STYLE RR, 75° C. POWER CABLE drastically slashes job costs when overloaded circuits in wet locations must be rewired. With RHW cable, you can increase current carrying capacity 18% to 50%, depending on ambient temperature, without increasing conductor size. This means there's no need to rip out and install new conduits to accommodate larger cable. Important savings in time, money and inconvenience are realized.

This versatile 600 volt cable*, suitable for operation at 75° C. in both wet and dry locations, is designed for service in underground ducts or above ground in conduits. Its insulation is specially compounded for superior aging and moisture resistant characteristics. The Roeprene sheath resists acids, most oils, moisture, flame and abrasion.

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commutation; and carbon brush materials. Westinghouse Electric Corp.

(61) FUSE CUTOUT with small-bore fiberglass-reinforced fuse tube is available in 50- and 100-amp ratings with IC's to 3000 amps for three types of fuses. Folder P-756, 4 pages, gives electrical and mechanical design features. Hubbard and Co.

(62) BLUEPRINT RACKS afford simple and compact method for vertical filing of plans without need of holes or other mutilations. Catalog 5, 8 pages, illustrates four styles of racks; prices included. Plan Hold.

(63) TRANSFORMERS. Booklet DL-1, 8 pages, is a compact manual on installation, operation, components and accessories, maintenance and inspection of distribution type transformers in ratings of 250 to 500 kva, three-phase. Moloney Electric Co.

(64) HAMMER AND DRILL combination electric tool is described in Bulletin 562. Capacities, applications and accessories are detailed. Wodack Electric Tool Corp.

(65) FANS for heavy duty industrial applications deliver over 92% mechanical efficiency and static efficiency of better than 88½%. Bulletin 4824, 8 pages, discusses design advantages of centrifugal fans and accessories. American Blower Corp.

(66) LIGHTING DESIGN handbook contains recommended footcandle levels for specific areas in a wide range of residential, commercial, institutional and industrial interiors. Precalculated footcandle tables simplify design functions. Additional material includes CU's of standard units, formulas and examples. Manual A-4854, 48 pages. Westinghouse Electric Corp.

(67) DISASTER DAMAGE REPAIR procedures are discussed in 12-page Bulletin GEA-6484. Booklet contains excellent material on organizing for maximum efficiency in restoring production; also methods for checking out electrical system for damage and reclamation of high-priority equipment. A must for plant engineers. General Electric Co.

(68) TIME SWITCHES, timers and accessories for multi-purpose and

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General Electric EMT speeds wiring jobs. Select, high-grade cold-rolled steel resists kinking and flattening—makes bending easier. The exclusive continuous induction weld means no splits—no uneven cross section to interfere with bending.

This induction weld also eliminates burrs and guards against snagging. Low-friction interior surface produced by special baked-on Glyptal* coating reduces drag, makes wire-pulling easier by actual test.

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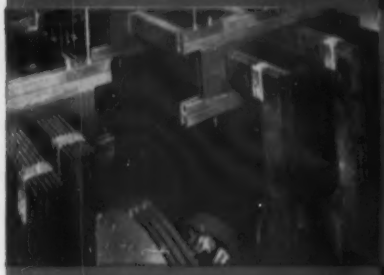

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industrial applications are detailed in 20-page Catalog 5700. Master selection chart aids in selection of proper timer or switch. Paragon Electric Co.

(69) FLUORESCENT BALLASTS. Bulletin FL-217, 16 pages, presents complete electrical and mechanical specifications on indoor and outdoor ballasts for rapid-start, slimline and instant-start lamps. Sola Electric Co.

(70) CATHODIC PROTECTION CABLES are the subject of 4-page folder covering physical and electrical characteristics of Gencathene and Aquathene cables for marine and chemically corrosive environments. General Cable Corp.

(71) MOTOR SELECTION pocket guide for farm, home and shop applications discusses points to consider and suggests proper motors for over 50 jobs. GED-2020B, 16 pages. General Electric Co.

(72) ELECTRIC HEATING. Features and ratings of ceramic radiant panels for wall, ceiling (suspended) or portable use are included in 4-page folder. Heatmore.

(73) CABLE TROUGH system designated Globetray features extensive line of fittings and accessories to afford flexibility in changing trough direction or elevation and to simplify installation. 12-page catalog. Globe Co.

New Books

Electrical Testing and Troubleshooting

An excellent handbook for the maintenance electrician, this compact, to-the-point manual avoids irrelevant discussion of theory, sticks right to the subject of how to locate trouble and what to do about it. Basic data and procedures for determining proper terminals and exact nature of control circuits form a solid basis for ensuing chapters covering rotating equipment, transformers and power cables. Each chapter includes a discussion of characteristics, interpretation of NEMA or ASA markings, and step-by-step methods for locating various kinds of faults. Additional material on testing devices and bearing lubrication complete this maintenance man's pocket guide.

By Phillip T. Green, Industrial Press, 93 Worth St., New York 13, N. Y. 191 pps. $4.00.

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Switches are equipped with wire leads and furnished complete with metal box and cover. Back and end knockouts for easy wiring.
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There's bigger profits in both new construction and rewiring jobs for you with *this* switch. Inexpensive . . . durable . . . it's just right for *any* door. Choose the amazingly sensitive P&S #1200 (Light On, Door Open) or #1201 (Light On, Door Closed). Activated by less than 14 ounces of pressure, it operates even under the light touch of accordion-fold doors, so popular in modern homes.

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Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Grounds on 32-Volt Railroad System

QUESTION W30 — Railroad passenger cars are generally operated on nominal 32-volt battery-powered systems with an axle-driven generator for charging. Because of vibration and moisture conditions combined with the age of much of the wiring, grounds are always a problem, especially since they usually affect the temperature control system. Unfortunately, at this low voltage the indications of an ohmmeter or high resistance voltmeter are useless, as they will indicate a dead ground where ground resistance is actually sufficiently high to prevent a lamp from burning. Frequently they are battery grounds caused by moisture on the cell tops.

What would be a quick, practical way of determining which grounds should be cleared, and which are harmless?—D.H.N.

ANSWER TO W30—For a 32-volt battery powered system the use of a zero-center portable indicator for grounds available from a number of manufacturers has aided maintenance considerably. This instrument shows at once at the circuit panel by opening switches progressively whether one or more circuits have grounds. By measuring the current flow with a multi-range ammeter the severity of the ground can be determined. Moisture on the cell tops with its acid content is a frequent cause and this can be reduced by cleaning off with ammonia and giving a light vaseline coating. Keeping the ground flow to 1% or less of the normal discharge rate has given satisfactory operation.—C.O.D.

ANSWER TO W30—The problem of a low-resistance short on a low-voltage circuit is one that can best be handled by a burn-out technique rather than an ohmmeter measurement. In other words, suppose we consider the case where the ground is caused by a small moisture drop. If we apply a fairly heavy current and the short will not disappear with the heavy current, then there is trouble, and it should be located and cleared.

You mention a 32-volt system. I would suggest applying a small welding transformer with a maximum voltage of say 25 volts, and a current limiting device in series with the output to limit the current to about 10 amps maximum. As a safety feature, I would put in a timing unit so that the current could not be left on for more than, say, one-half a minute. Then, if the circuit clears itself, fine; if not, the ground is a serious one and the application of the curent will not cause too much damage.—H.H.S.

ANSWER TO W30—Accidental grounds on a 32-volt system are quite annoying and at times troublesome to find as you have already experienced. Also as you mentioned battery grounds are quite frequent. This condition is sometimes quite evident by noting the condition of the cell exterior and mounting of the cells. On 24-volt and 32-volt systems we make it a practice to clean the cells thoroughly with soda in water and then to change the wooden boards on which the cells are mounted in the metal rack. Also we Megger the entire circuit and isolate if necessary to segregate the grounds.

However it should be noted that the items of most importance should be in good condition such as any heating equipment and associated relays as well as a certain amount of lighting. These components must necessarily include the wiring too. The aforementioned notes have been responsible for finding most of our accidental grounds. One more thing to note is an indicator of some sort which is used to determine whether a ground exists. Should a light be used for this purpose, the intensity of the light bulb often indicates the severity of the ground.—J.B.K.

AC vs DC Feeder Identification

QUESTION X30—Is there any simple method that can be utilized to identify either ac or dc feeders (as the need may be) from a group of ac and dc feeders in a common wireway?—J.M.

ANSWER TO X30—Simple identification of ac and dc feeders can be made by use of an incandescent lamp providing the voltages involved are known and do not exceed the lamp rating. By connecting the lamp across the ac feeders and waving the hand rapidly across the lamp, a noticeable stroboscopic effect can be observed. With the lamp across dc feeders, you will find that the stroboscopic effect is not observed.

If the voltages involved are higher than the lamp rating, a resistor in series with the lamp can be used to reduce the voltage to a safe value for test.—R.E.B.

ANSWER TO X30—By far the most practical method of identifying ac and dc involves the use of nothing more elaborate than the common neon glow lamp voltage indicator. If the circuit is ac both electrodes will glow; if it is dc only one will glow. Naturally this requires a location where the cable may be opened, as at a splice or junction box.

Like many problems this is best licked by prevention. If conductors are color coded or marked with "stick-on" labels as they are installed, there will be no future difficulty in selecting the proper circuits.—D.H.N.

ANSWER TO X30—Probably the simplest way is to use an ordinary hook-on ammeter. Assuming all feeders are carrying current, the ac feeders will give a reading, but the dc feeders will read zero regardless of the current they are carrying.—E.J.P.

Calculations for Short-Circuit Duty

QUESTION Y30—I have heard a great deal about short circuit calculations, especially in industrial plant distribution. When do such calculations become necessary, and what determines the need of current-limiting fuses and busways? —D.H.N.

ANSWER TO Y30—Short-circuit calculations become necessary:

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McGill 5000 series grounded service lights feature the convenience outlet and plug adopted as standard by Underwriters' and the National Electrical Code. Blade arrangement includes parallel blades and U shaped third blade for ground. This heavy duty portable and any attached power tools are completely grounded. Molded phenolic handle is heat and impact resistant and positively insulated. Heavy wire cage featuring end lens is zinc plated with chromate finish. Available with or without black rubber 16-3-SJ cord and Levolier Switch.

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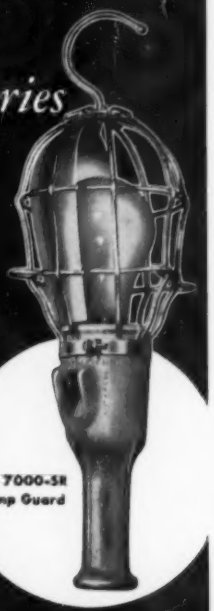
McGILL 7000 series *gray handle portables with* NEOPRENE-BUTYL *for greater grease resistance*



Distinctive in appearance, the new, gray, neoprene-butyl handle offers superior grease resistance, won't rub off, mark walls, clothes or floor. Retains shape and resists deterioration under any service conditions.

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water-tight vapor-tight and moisture proof

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NEW portable

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where the systems under consideration are large, divided into many branches, have a heavy motor load; where the short-circuit current available is considerable, especially in higher voltage systems; and where the short-circuit current cannot be determined by inquiry or reference to the tables furnished by equipment manufacturers.

Where such is the case the engineer must resort to the many available reference texts on the subject and to publications issued by the American Institute of Electrical Engineers, utilities, and large equipment manufacturers.

There are many methods of avoiding detailed calculations for the ordinary system, however. The local utility, for instance, usually will indicate the short-circuit current available at the service bus, and manufacturers of fuses and circuit breakers publish interrupting ratings of their devices to match the incoming line. Manufacturers of transformers, especially those involving unit substations, also publish tables showing available short circuit currents and breaker rating to meet the requirements. Cable manufacturers likewise furnish data indicating the length in feet of various size cables and bus necessary to reduce the current to values easily interrupted by smaller fuses and circuit breakers. In any event, the short-circuit current must be determined and satisfied at the protected points with interrupting devices of adequate rating, and this determines the need of current-limiting fuses and busways.—R.G.O.

ANSWER TO Y30—Bus and bus-duct systems, switches, panelboards, switchboards, etc., are mechanically designed to withstand the stresses built up by fault currents of a pre-determined value. Larger currents would create forces which would tend to collapse the conductors. Circuit breakers, fuses and contactors are limited insofar as their ability to interrupt fault currents. Should these devices be required to interrupt currents exceeding these values, they may destroy themselves with ensuing damage to surrounding life and property. It is, therefore, necessary to determine what the maximum fault current would be at any point in the system before selecting the equipment to be installed at that point.

Each piece of equipment installed in series with the service conductor offers impedance to the flow of cur-

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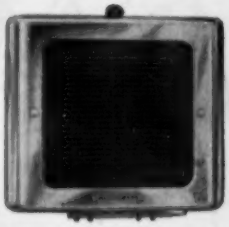
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✓ PUMP HOUSE HEATERS

MILK HOUSE HEATER
Also useful for brooder pens, fruit and vegetable bins, etc.

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rent. This includes the generators themselves, cables, transformers, reactors, etc. Additional sources of fault currents are synchronous and induction motors which pump power back into the line under faulted conditions.

Short-circuit current calculations should be made on every installation. However, they may be greatly simplified for small systems fed through one transformer bank.

Current-limiting fuses are used to interrupt the fault current before it reaches its peak value, thus protecting equipment from excessive current.

Current-limiting busways are used to offer greater impedance to the flow of current, thus reducing the maximum available fault current to a value safe for the installed equipment.—L.S.

Problem With Drill Bits

QUESTION Z30—We are confronted in our shop with a great deal of expense on breakage of electricians' bits, using ¼ in. and ½ in. electric drills. Most of this work is done in new houses and we have been unable to get any type bit which will last for any length of time.

This is one of the greatest expenses that we have as we have been unable to get any bits that were satisfactory.—A.M.S.

ANSWER TO Z30—Use a low torque drill, so that the drill will stall if the mechanic forgets to remove the chips in time, or if due to another reason the bit gets locked. I use flat bits sold by Sears Roebuck, and it is easy to unlock them. For places that may have nails, I use a machinist's bit. I keep my bits sharp. I use a ¼ in. drill for the flat bits. A shearing pin can help.—H.S.

ANSWER TO Z30—In referring to electricians' bits, I assume you mean the bit used for drilling in wood rather than a bit used for steel. The power wood bits give extremely good service when used properly and I must stress proper use. Any bit, no matter how well constructed, can be broken by improper use. Therefore your first problem is orientation in the proper use of the tool. Secondly, if the situation is caused by carelessness, then the only answer is a drastic one which would entail the electricians' supplying their own bits.

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16

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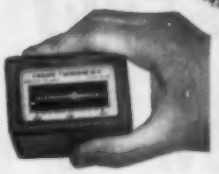

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However this last suggestion must be carefully resorted to for its effects may do more harm than help.

I do believe though that a worker will use the tool to its best advantages when properly instructed in its use. Try several brands of bits on an experimental basis and select the one most suited to your particular jobs, however be instructive and constructive instead of destructive.—J.B.K.

Can You ANSWER These QUESTIONS?

QUESTION H31—A 37½ kva, single phase 480- to 120-volt transformer feeds a large number of automatic electronic calculating machines. The burning out of relays and other troubles occurring in these machines is continuous. We now have a recording voltmeter on the load side which records the voltage over a 24-hour period. The voltage varies from 118 volts to 132 volts. The local power company has already told us that the lines feeding this plant are not regulated at the power house, and our company will have to take care of our own regulation. Can anyone suggest a method of automatically stabilizing the voltage to 120 volts on the load side of the transformer?—R.A.M.

QUESTION J31—Where an induction motor has more than one winding per phase and the windings in each phase are connected in series, could the power factor of the induction motor be improved by connecting a capacitor across one winding in each phase and depending on the auto transformer effect to introduce a leading current into the induction motor? Would this have any detrimental effect on the motor? Would the beneficial effect be greater than the detrimental effect?—E.B.

QUESTION K31 — Could someone tell me an economical way of testing field coils in universal type motors, such as drills, saws, vacuum cleaners, etc.? Most are too small for an internal growler to fit into and it would take an expensive ohmmeter to find a short coil.—C.H.

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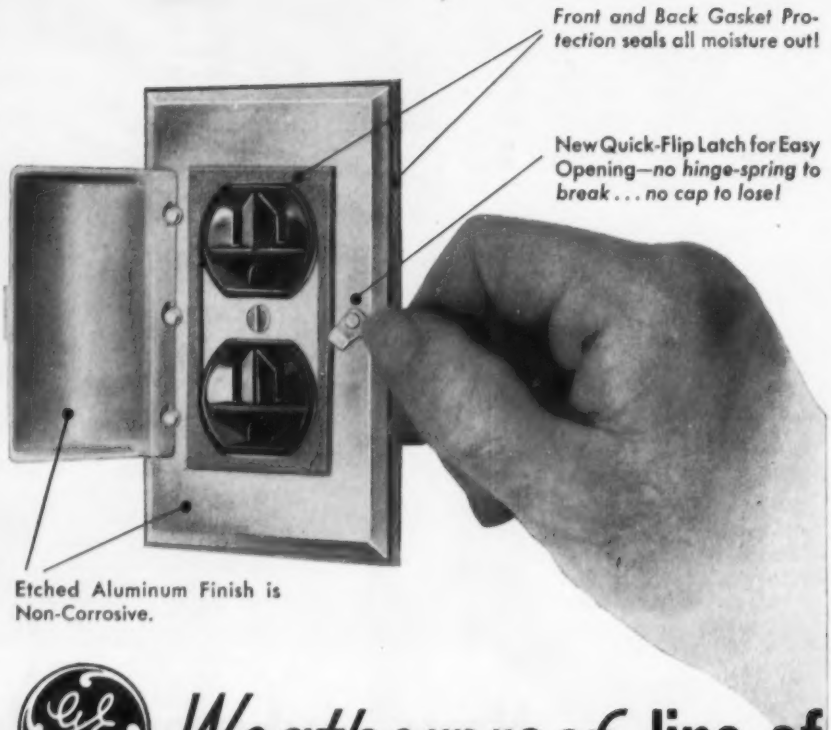
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Questions on the Code

Answered by

B. A. McDONALD, New York Board of Fire Underwriters, Rochester, N. Y.
GLENN ROWELL, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.
B. Z. SEGALL, Consulting Electrical Engineer, New Orleans, La.

Overfusing Motor Branch Circuit Conductors

Q. *In the May, 1956 issue of EC&M, on page 111, an example is presented which shows how to calculate the feeder size and feeder overcurrent fuse size for a feeder to group motors. I agree with the method 100%; however, I would appreciate an explanation to the following question:*

Since the fuse size (300 amps) is more than 150% of the wire current carrying capacity (165 amps); would the installation as such be a violation of the Code rule 2403(a) which states "If the allowable current-carrying capacity of a conductor does not correspond to the rating of a standard size fuse, the next larger size or rating of fuse may be used but in no case shall the size or rating of the fuse exceed 150% of the allowable current carrying capacity of the conductor"?

If this rule does not apply, please advise why not and if it does apply I assume that the obvious solution would be to increase the cable size so as to conform with the rule.—R.C.L.

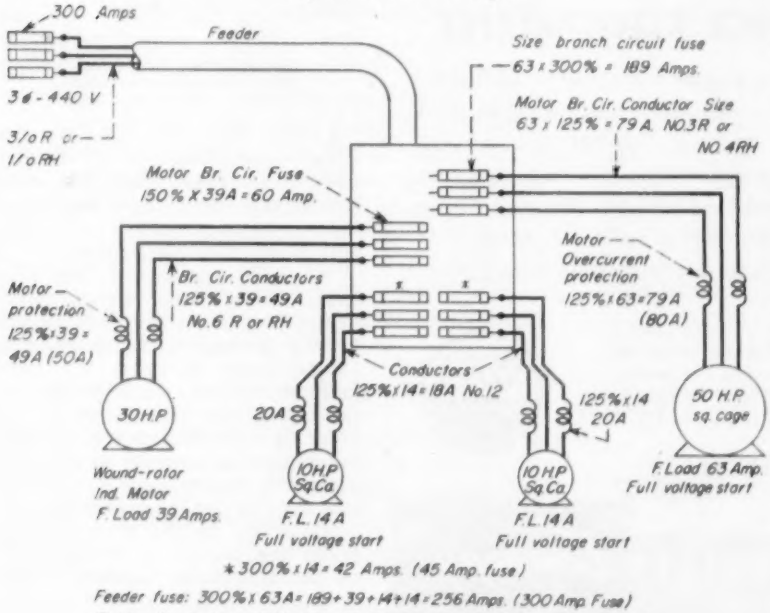
A. For the benefit of our readers we have illustrated the calculations involved with the motor problem presented in the May 1956 issue of E.C.&M. on page 111. See illustration.

In answer to your Code question we wish to advise that Section 2403-a of the Code is only one of the methods recognized by the Code for the overcurrent protection of conductors, and as you say, it provides for up-rating fuse sizes when the allowable current-carrying capacity of the conductor does not correspond to the rating of a standard size fuse, provided the fuse selected does not exceed 150% of the allowable current-carrying capacity of the conductors Standard size fuses are also covered by Section 2403-a and it should be noted that the necessity to overfuse more than a few amperes may be eliminated, in some cases, when a fuse other than the standard size is available and used. This rule from a practical standpoint is most essential since it is obvious that fuses rated for the various current-carrying capacities of conductors, as given in Tables 1 and 2 of Chapter 10, would create a problem of standardization that would not be justified in view of the degree of safety established by the Code.

Insofar as the motor problem is concerned, the feeder conductors are overfused more than 150%. Section 2403-e recognizes such protection by reference to Section 4362, which provides for the starting current of the largest motor plus the full load currents of the other motors. In the example presented, the feeder overcurrent device is computed at 256 and since the next standard size fuse is 300 amps, it has been shown as suitable for use. Such overfusing could be eliminated by the use of double throw switches, or alleviated to a degree by the use of time-lag fuses. Such procedure however is not required by the Code and field experience over many years does not indicate the necessity for change.

Section 2403-a does not apply to the motor problem presented outside of the overfusing necessary to use a standard size fuse. There is no conflict in Code rules and there is, in my opinion, no Code violation.—B.A.McD.

Typical Motor Circuit Calculations
May Issue E.C.+M. Page 111


300 Amps
Feeder
3ϕ - 440 V
3/0 R or — 1/0 RH
Size branch circuit fuse
63 x 300% = 189 Amps.
Motor Br. Cir. Conductor Size
63 x 125% = 79 A. NO 3R or NO 4RH
Motor Br. Cir. Fuse
150% X 39A = 60 Amp.
Motor — protection 125% x 39 = 49A (50A)
Br. Cir. Conductors 125% x 39 = 49A No. 6 R or RH
Motor — Overcurrent protection 125% x 63 = 79A (80A)
Conductors 125% x 14 = 18A No. 12
125% x 14 20A
20A
30 H.P. Wound-rotor Ind. Motor F. Load 39 Amps.
10 H.P. Sq. Ca. F.L. 14 A Full voltage start
10 H.P. Sq. Ca. F.L. 14 A Full voltage start
50 H.P. sq. cage F. Load 63 Amp. Full voltage start

* 300% x 14 = 42 Amps. (45 Amp. fuse)

Feeder fuse: 300% x 63A = 189 + 39 + 14 + 14 = 256 Amps. (300 Amp. Fuse)

Feeder Conductors: 125% x 63 = 79 + 39 + 14 + 14 = 146 A. (3/0 R or 1/0 RH)

Common Neutral

Q. *In a four story building which I am now wiring, I plan to run three sets of feeders from the service equipment in the basement with one set terminating on each of the floors above the basement. As there is only single phase current involved, is it possible for me to use a common neutral for each of these three sets of feeders with a tap off the neutral at each distribution panel on each floor?—W.C.*

A. Section 2204 of the Code provides that a common neutral may be used for two or

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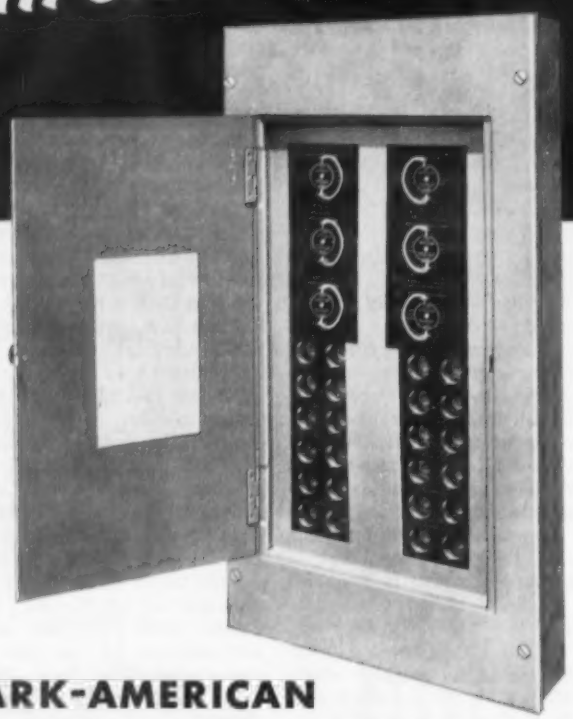

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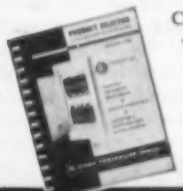

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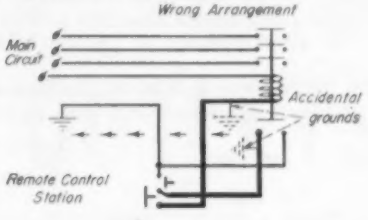
three sets of three wire feeders. Therefore it would be possible for you to use a common neutral between the service equipment in the basement and the three floors above the basement being supplied from this service. The only restriction would be that all conductors using the common neutral would have to be within the same metallic enclosure if a metallic enclosure were employed. You will also note that this same section gives permission to use a common neutral with two sets of four wire or five wire feeders.—G.R.

Remote Control—Motors

Q. *Section 4373 of the National Electrical Code states: "It is recommended that control circuits be so arranged that an accidental ground will not start the motor."*

It seems to me that the safest method of feeding a control circuit is by means of a transformer. This would isolate the control circuit and meet the above recommendation. Am I right about this?

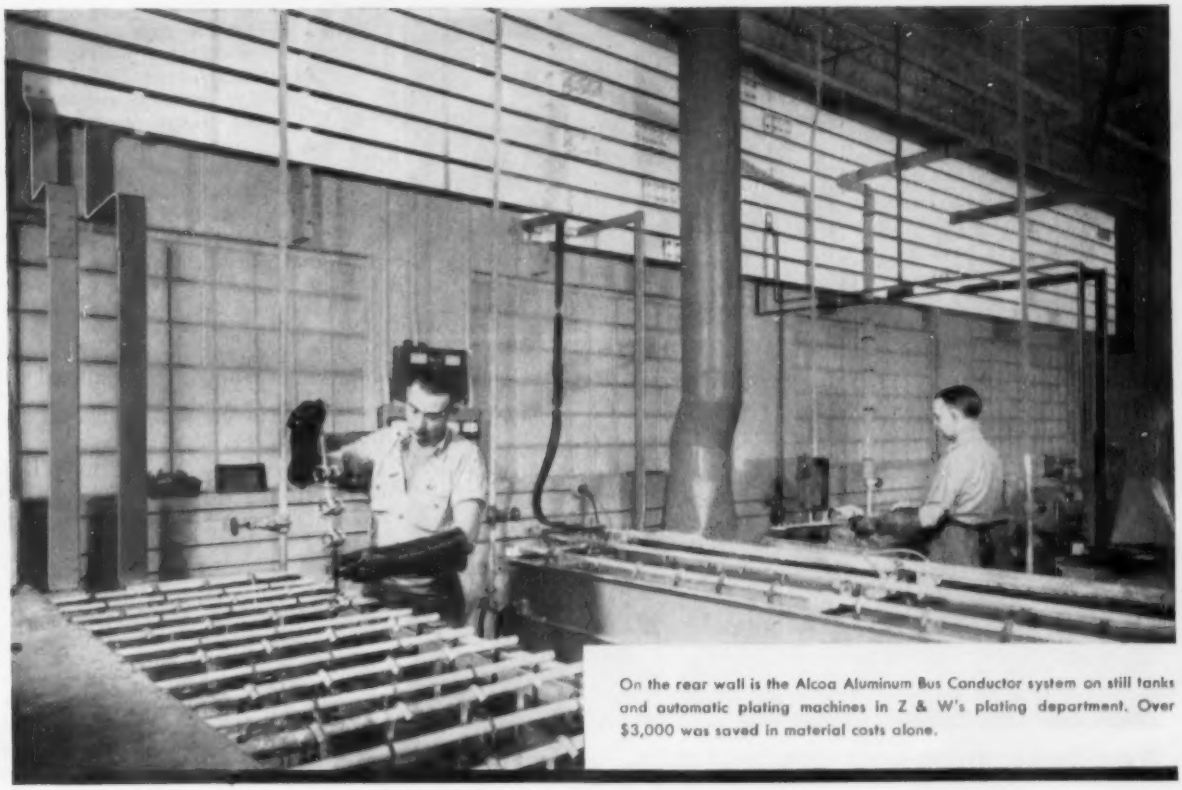
Please advise me on this matter with regard to both grounded and ungrounded systems.—C.C.K.



Reverse wiring so that grounded neutral feeds coil and operating contacts are fed by phase wire.

A. In order to clarify the recommendation of Section 4373, Segall's Electrical Diagrams clearly illustrates the hazard presented when a grounded control circuit is improperly arranged.

We have reproduced this diagram which shows how an accidental ground on any part of the heavily outlined wiring system will automatically energize the controller-operating coil, close its contacts, and thus start the motor. In order to avoid this hazard the wiring should be reversed so that the grounded neutral feeds directly into the coil and the operating contacts are fed by the phase wiring. When the circuit is reversed an accidental ground on the contact circuits will cause a short circuit and blow the overcurrent device.



On the rear wall is the Alcoa Aluminum Bus Conductor system on still tanks and automatic plating machines in Z & W's plating department. Over $3,000 was saved in material costs alone.

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Having some small copper bar stock on hand, they used that as leads in some places—other leads were aluminum. Trouble-free joints between copper and aluminum were made, as were all joints, with Alcoa Electrical Joint Compound and aluminum bolts.

Saves 50% on bus conductor

The same technical advice and assistance from Alcoa that enabled Z & W to engineer, design, fabricate and install this bus system are yours for the asking. Study how much you could save with Alcoa Bus Conductor—for expansion or modernization. Cost is about half. Just check the Yellow Pages of your phone book under "Aluminum" for Alcoa's nearest office. Or write, Aluminum Company of America, 2310-L Alcoa Building, Pittsburgh 19, Pa.

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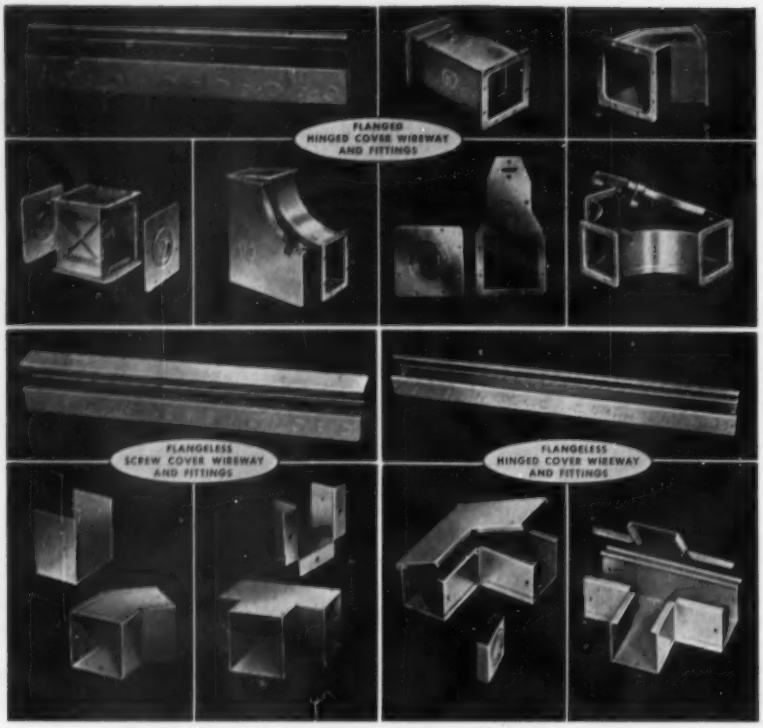

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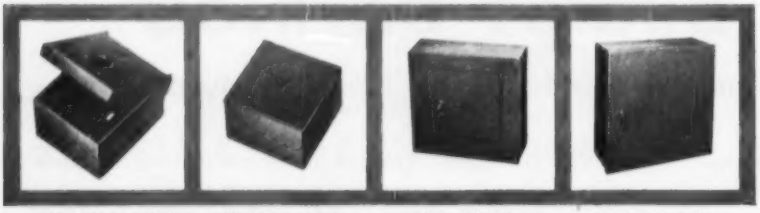

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An accidental ground on the grounded conductor will result in an unintentional ground but will not result in motor operation.

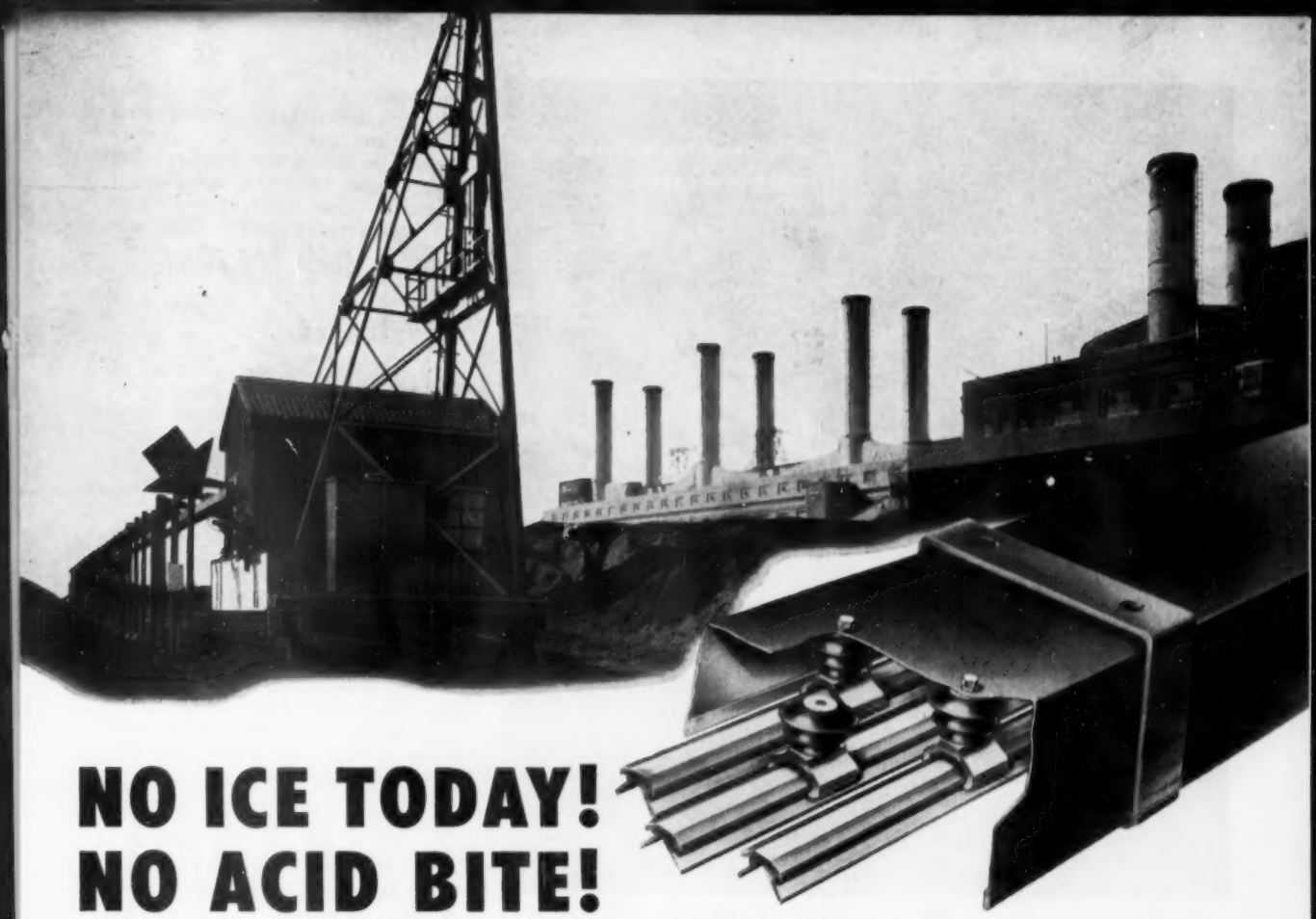
When the control circuit is derived through a transformer and one of the secondary conductors is grounded, the situation presented above has not been improved. The same hazard of the accidental ground continues to prevail. I mention this factor since the provisions of Section 7271 require grounding under certain conditions.

If the transformer is ungrounded however, we tend to minimize the hazard since both conductors of the circuit would have to become accidentally grounded before the motor would operate. There is a possibility however that this could happen and in the absence of any ground detecting device, we would have no indication of the imminent hazard. When one wire of the control circuit is grounded and the grounded conductor feeds the coil, we have reasonable assurance that the overcurrent device will operate when an accidental ground occurs on the live conductor. In the first case a possibility exists and in the second case the impedance of the ground circuit coupled with the overfusing recognized by the Code could interfere with the prompt operation of the overcurrent device. —B.A.McD.

Range Circuit

Q. *We recently ran a range circuit through the crawl space under a house without a basement and attached the three conductor No. 6 range cable to the bottom faces of the floor joists. Now we are advised that this cable should be removed and replaced by conductors within raceway, or if cable is used it should be run through bored holes in these joists. Is this a Code requirement?*—B.P.

A. Under Section 3381 you will note that where service-entrance cable is used as a wiring material, such as it is in your case as a circuit for an electric range, the Code provides that unarmored cable shall be installed in accordance with the applicable provisions of Article 336. Then under 3366 of Article 336 you will find that assemblies not smaller than two No. 6 or three No. 8 conductors may be secured directly to the lower edges of the joists in unfinished basements, while smaller as-



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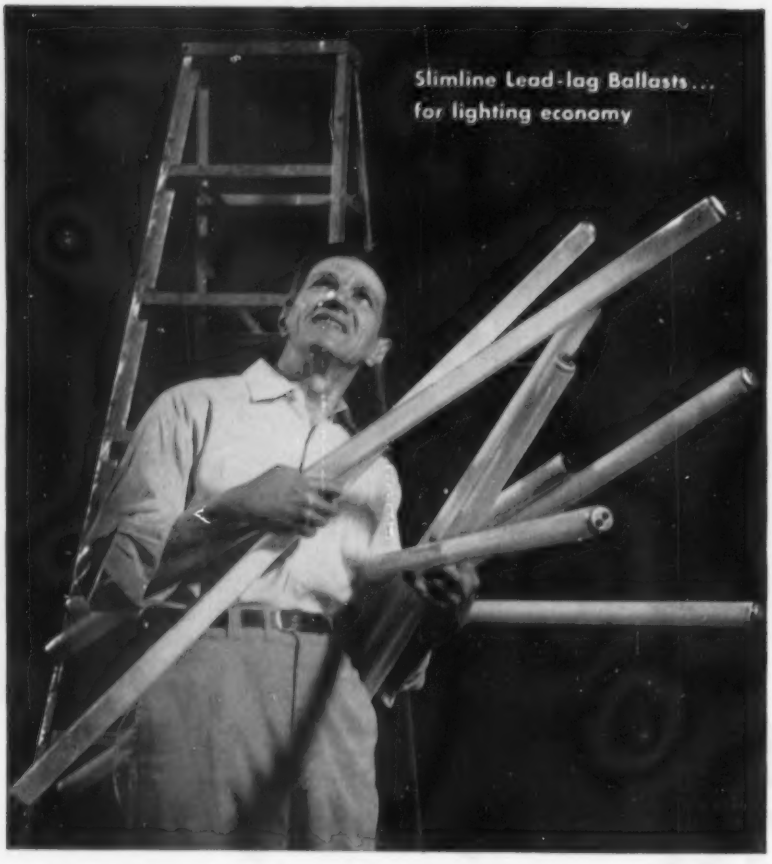

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J-04401

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semblies shall be run either through bored holes in the joists or on running boards. Therefore the Code would not require that you remove this cable and place it through bored holes or replace it by conductors within conduit.—G.R.

Panelboard

Q. *If a panelboard is rated at 300 amps, is it necessary to supply that panel with feeders having the ability to deliver 300 amps even though the load connected to that panel may be considerably less?—E.G.*

A. Section 3880 states that the panelboards shall have a rating not less than the minimum feeder capacity required for the load as computed in Article 220. Therefore, if your computed load is considerably less than 300 amps, it is perfectly proper to use feeders capable of supplying that load even though the panel has the larger rating.—G.R.

TW and AVA Conductors—Same Conduit

Q. *What does the Code have to say regarding the use of type TW wire and type AVA wire in the same conduit where ambient temperature of the area suits TW? AVA was used to keep wire size down. Won't the high operating temperature of AVA harm the TW when in the same conduit? For example, is it permissible to put three No. 2 TW pulling 76A and three No. 2 AVA pulling 108A in the same 2-in. conduit?*—G.F.

A. One factor to be considered with such a combination of conductors is the fact that TW insulation is primarily designed for use in wet locations while AVA insulation is limited to dry locations. TW insulation may also be used in a dry location. I assume, with the example in question, that the location is a dry location.

I am unable to find where the Code specifically covers the question you submit. It is my opinion however that Note 6, following Tables 1 and 2 of Chapter 10 expresses the fundamental involved. It reads as follows:

"Ultimate Insulation Temperature. In no case shall conductors

1. insert nail stud

2. load cartridge

3. . . . and *FIRE!*

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Here it is . . . a completely new idea for fastening. Nail studs are *pushed* through metal or wood into concrete . . . not *shot* in. Result: elimination of the hazard of ricochets.

This maximum-safety tool uses low-cost, conventionally shaped nail studs—needs only one type and load of cartridge for all applications.

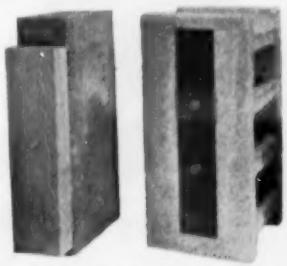
Power adjustment ring at end of barrel assures uniform penetration of nail stud, so there's never any accidental piercing completely through the working surface.

Double-action firing sequence prevents accidental discharge. Fires only when firing pin is placed in firing position. Alignment of two red dots on barrel housing indicates firing position.

Easy breech loading . . . automatic cartridge ejection . . . no barrels to manipulate . . . all make for fast, easy operation, saving time and money.

The Stud Hammer comes in a convenient carrying case and has ample room for a supply of nail studs and cartridges. Three spall shields are available for use with the tool: a round flat disc for open work; a long narrow one for work in close quarters; and a channel-shaped one for use in anchoring two-by-four lumber. Choice of three nail stud sizes: 1¼", 1¾" and 2¼" long.

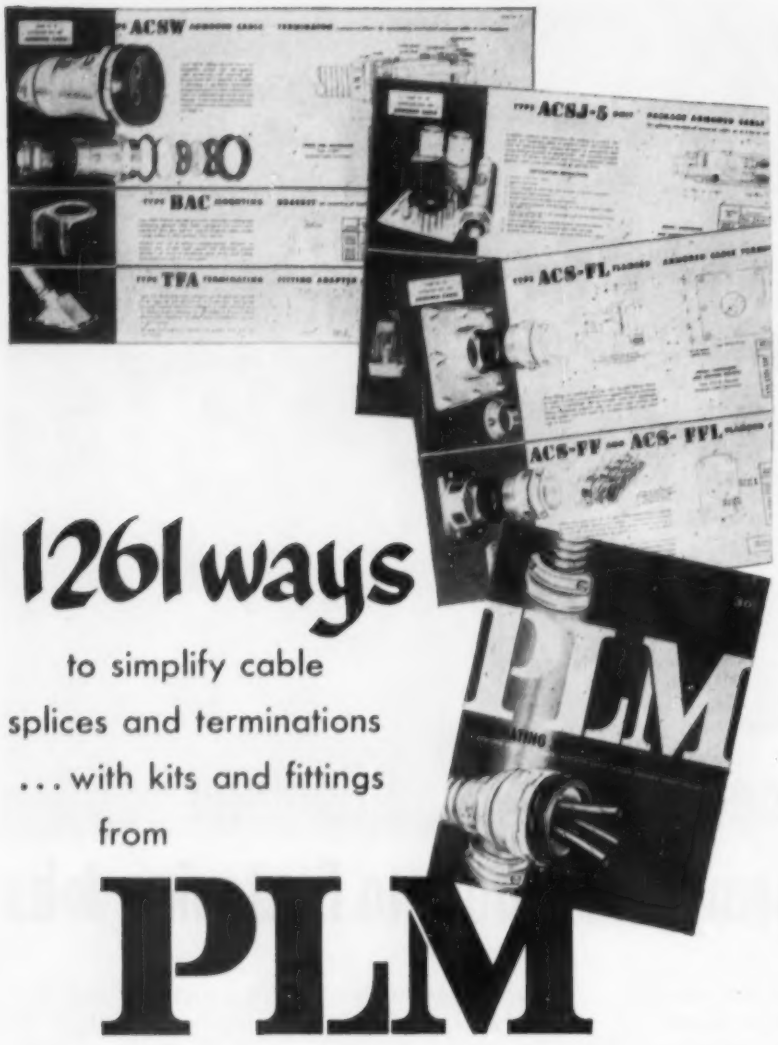
You'll be taking an important step toward greater safety and economy in your fastening operations when you use the new Velocity-Power Stud Hammer. Write us for further information.



No drilling, no plugging, no anchoring necessary with the new Velocity-Power Stud Hammer. Fastens wood or steel to concrete in seconds.

VELOCITY POWER TOOL COMPANY

201 North Braddock Avenue, Pittsburgh 8, Pennsylvania



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WIRE AND CABLE FITTINGS AND ACCESSORIES

be associated together in such a way with respect to the kind of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of the conductors will be exceeded."

Since the maximum operating temperature of TW insulation is 140 F and AVA insulation is 230 F, it appears obvious when such conductors carry 80% of their full rating, 76 and 108 amps respectively, the conductors will reach their limiting temperatures when operating in an ambient temperature of 86 F. Under such conditions of operation the insulation of the TW conductors would be damaged even though they carried no current at all. A TW conductor exposed to an ambient temperature of 140 F is not permitted to carry any current.

In view of the foregoing opinion I do not believe that the Code ever intended to recognize both TW and AVA insulated conductors, loaded to their rated capacities in the same conduit. If however such a combination is desired, I believe that the objective expressed by Note 6 would be satisfied if the current in the No. 2 AVA insulated conductor was limited to that recognized for the No. 2 TW conductor, which in this case would be 76 amps. Such a limitation would eliminate the advantage of additional carrying capacity incident to the use of AVA insulation. A possible application however might occur when such conductors are run between resistance elements and controllers.—B.A.McD.

Neutral Currents

Q. *The neutral wire cannot be ignored in a conduit especially when there is a mixed load because it does carry current and occupies space, which limits the percent of free area for heat dissipation of all conductors. Will you please explain.*—E.B.L.

A. Insofar as the Code is concerned, a neutral conductor, as you say, occupies space in a conduit and it must be counted when determining the size of the conduit. Note 5 following Tables 1 and 2 of Chapter 10 definitely advises that a neutral conductor which only carries the unbalanced current from other conductors—shall not be counted in determining current-carrying capacities as provided for in Note 4. One exception to this rule concerns electric dis-

A Drafting Room Needs the Best Light It Can Get ...It Gets It Here with Lighting by LITECONTROL!

This large area of The Clarkeson Engineering Company, Inc., Boston has all the working light required without excess brightness at desk and drawing board level. Intensity is 61 footcandles average, a year after installation.

The two lamp louvered fixtures by Litecontrol in addition to assuring low brightness, feature trim appearance and easy installation and maintenance. Yes, and because these are *standard* fixtures, they will meet the budgetary requirements of almost any firm or company seeking quality lighting at moderate cost.

Louvers are hinged from either side for servicing without the need for tools. The frame around the louver's sides provides rigidity, eliminates sharp edges.

Next time you have a large commercial area to illuminate (or a smaller one) where you want the right amount of light in the right places — in any intensity or combination of intensities, call on Litecontrol. We have a standard fixture which will do the job — and save money in addition.

INSTALLATION: The Clarkeson Engineering Company, Inc., Boston, Massachusetts

AREA: Drafting Room

ELECTRICAL CONTRACTOR: Gaston Electric Company, Boston, Massachusetts

FIXTURES: Litecontrol #5328 and #5324 2-lamp louvered fixtures, 8 ft. and 4 ft. long, pendant mounted on 18" stems.

MOUNTING HEIGHT: Approximately 9'-0"

FIXTURE SPACING: 9'-0" on centers

INTENSITY: 61 footcandles average, after one year's service

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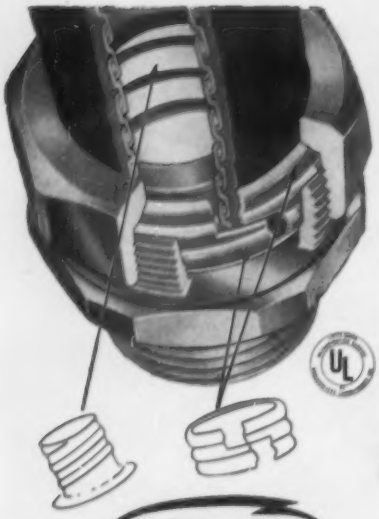
DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS



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VAP-OIL-TITE CONNECTORS

For Liquid-Tight Flexible Metal Conduit

The only completely REUSABLE connector!

PROVIDES PERMANENT WIRING PROTECTION

● Easy-to-apply... Ideal-Simplet Vap-Oil-Tite Connectors adjust quickly to conduit size variations. They positively seal out vapor, oil, water or dust. Grounding bushing assures positive ground . . . flange covers raw ends of conduit . . . and you can actually see that the bushing seats all the way!

Exposed parts all *non-corrosive* metal, Vap-Oil-Tite Connectors have positive ground, tapered threads, and tremendous gripping power through serrations on split ring. Underwriters' Laboratories, Inc. approved with 200 lb. pull test. Fit both EF and UA conduit. Write for further details and prices.

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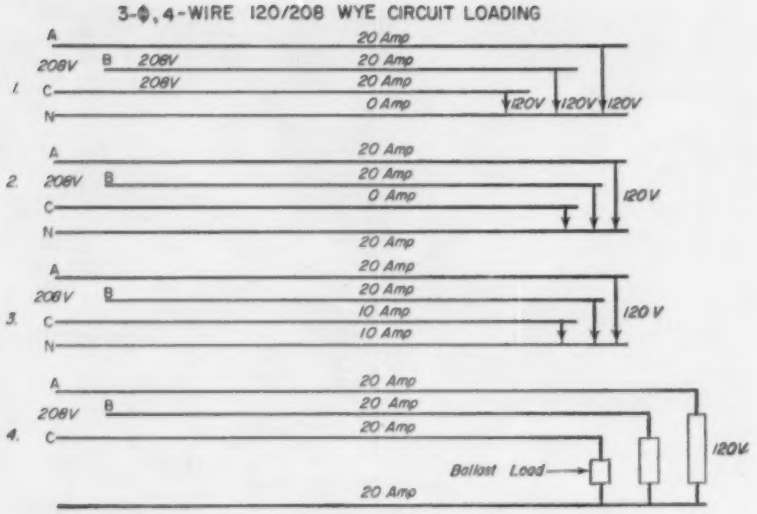

charge lamp ballast loading. The 1956 Code under Section 2203-g will be amended to read as follows: "In a feeder whose load consists of 50% or more of electric discharge lamp ballasts, there shall be no reduction in size of the neutral conductor below the size of the phase conductors." This amendment was prompted by the fact that fluorescent ballast loads connected between the phases and ground of a 4-wire, 3-phase wye produced neutral currents approximating the phase currents due to third harmonics developed by the ballasts. This new Code provision undoubtedly will be recognized under Note No. 5.

The Code with the exception noted does ignore the neutral conductor when determining the current-carrying capacity of the other circuit conductors in a raceway, and I personally believe the reasoning is correct. Assuming that the power factor of the various loads are equal, I am unable to visualize any combination of load which would result in a heating effect equivalent to that produced by four conductors carrying full rated current.

As shown by the illustration (1) the neutral conductor carries zero current when the phases are equally loaded. When two phases are loaded (2) with no load on the third phase the neutral carries 20 amps. (3) When phase A and B carries 20 amps and phase C carries 10 amps, the neutral carries 10 amps and this value will increase or decrease in proportion to the amount of current in the C phase. When ballast loads are involved (4) the neutral will carry about the same average current in the phase wires.

If however one phase operates at a poor power factor, say 30 degrees out of phase, and the other phases operate at unity power factor, we could obtain a condition where the neutral conductor would carry current approximately 1.41% of that in the phase conductor. —B.A.McD.

Vertical Bus

Q. *For feeders in a store building, we are using a vertical bus, extending it through existing floors. Will it be necessary for us to enclose this bus within a plaster or tile or steel enclosure from the panel on one floor to the panel on the next floor?*—D.R.

A. No, the Code would not require the enclosure of the bus provided a bus of the nonventilated type were used where it passes through the floor and to a point at least 6 ft above each floor level, or if a panel is to be supplied on each floor, the bus between the floor level and the attachment to the panel would have to be of the unventilated type. Section 3644 of the Code covers this problem and the second sentence reads as follows: "Busways may extend vertically through dry floors if totally enclosed (unventilated) where passing through and for a minimum distance of 6 ft above the floor to provide adequate protection from mechanical injury." The use of the term "totally enclosed" simply refers to the enclosure for the bus itself and does not indicate a second enclosure about an enclosed bus is necessary.—G.R.

Something New in Lighting

■ New Curtis Color-Magic Golden Alzak Edge-Glo brings a fresh beauty to traditionally colorless commercial ceilings. New Curtis Golden Alzak uses the same high purity grade aluminum as Curtis Silver Alzak, and has the same hard, transparent aluminum oxide sheath that forms the non-tarnishing, easily maintained finish that is Alzak, plus a life-time of permanent color beauty that never needs refinishing. New Curtis Color-Magic Golden Alzak Edge-Glo is available in 2, 4, and 6 lamp sizes and a variety of bottom closures for complete versatility and the finest in quality lighting, just like the Silver Alzak and white Fluracite enamel finished Edge-Glo. Send coupon for New Curtis Color-Magic Golden Alzak Edge-Glo data.

Curtis Lighting, Inc., 6135 W. 65th Street, Chicago 38, Illinois

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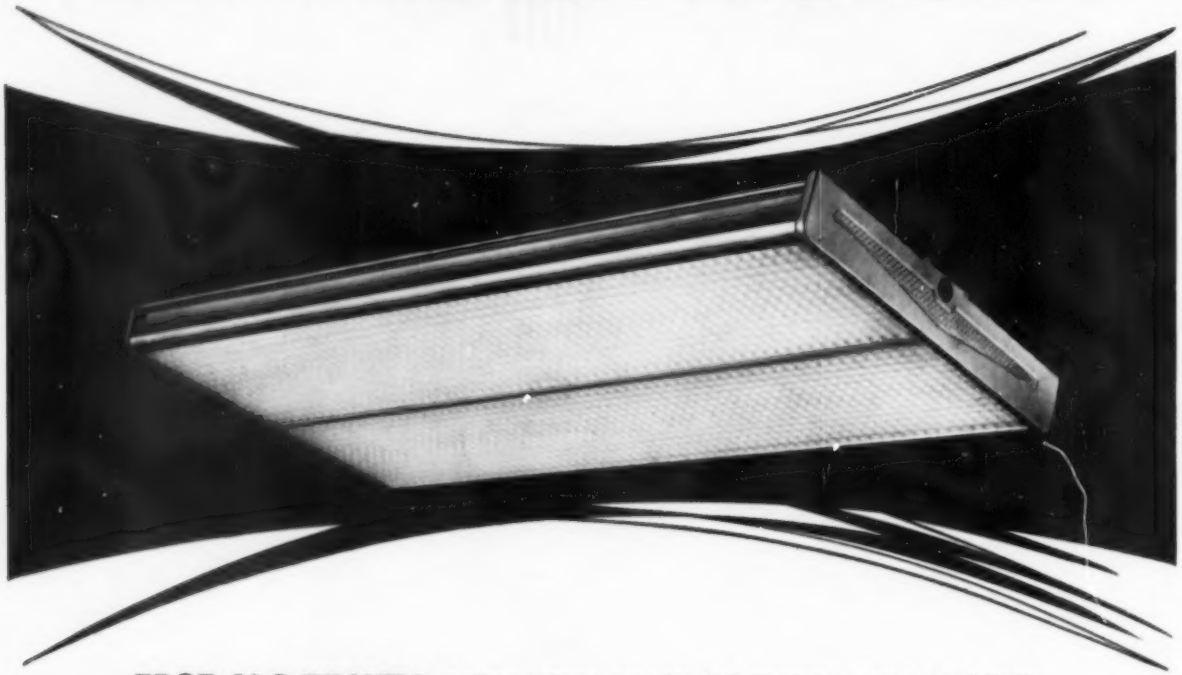

EDGE-GLO BEAUTY, its simple richness, and Edge-Glo's illuminated sides add a distinctive touch of exclusiveness to offices, stores or any other interior.

EDGE-GLO VERSATILITY, it's unlimited. There's two sizes, 12¼" for two lamps and 23³⁄₁₆" for four and six lamps; four bottom closures—Holophane Plastic Controlens®, Plastic Egg-Crate, Flat Acrylic and Honeylite—and there's three different finishes—Silver Alzak, Golden Alzak and white Fluracite enamel—all on high purity grade aluminum.

EDGE-GLO EASY INSTALLATION, it's fast and costs less. Units can be direct ceiling mounted over an outlet box with a simple hickey and locknut arrangement, or suspended with Curtis stem hangers. The stem hanger with plastic canopy and positive-lock ferrel eliminates time-wasting set screws. The patented Curtis "Tong" hanger permits suspension at the juncture of two units, and further facilitates and cuts installation costs by permitting the by-passing of beams and sprinkler heads, etc.

This is what you get with Edge-Glo. See it at your authorized Curtis wholesaler or get complete information by sending the coupon below.

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DETROIT CONTRACTOR ADOPTS

LBE Slogan on New Homes

IN JUNE, a new type of promotion for housing developments broke in the Detroit area. It brought together a contractor, a builder—and the slogan, "Live Better Electrically."

Smith Brothers Electric, Inc., the contractor, thus added to an already extensive promotional arsenal on new-home wiring. The firm's main effort, started in earnest in 1955, has been to sell up wiring with personal sales calls—an effort which increased, by the records, Smith Brothers Electric average new-home wiring bill $140 last year.

Partners George and Hubert Smith have long believed that upgrading the wiring market is no job for the contractor alone. Tie-ins with programs such as Adequate Wiring have been standard practice. Says George Smith: "We've been in the residential end for years now; it's 30% of our business. We particularly like new-home wiring now, with all the industry-wide wiring and electric-living programs, and find that these programs are helping us to reduce consumer resistance where it counts for the contractor at the point-of-sale."

The Live Better Electrically promotion—which involves personal sales calls, signboards and newspaper advertising—took root last February when George Smith was a guest of Detroit Edison Co. for the closed LBE telecast. He and his brother liked the show, and felt it had a place in their firm's operation. With the builder, they decided to use LBE material in sales letters and the program's symbol on signboards and in advertising, beginning in June.

The basic sales promotion, incorporating LBE, was built around personal calls on new-home buyers, before the wiring was roughed-in, to sell electrical extras. Working with builder George Glover, Inc., Smith Brothers Electric set up a simple operating plan. Glover was to pass along the names and addresses of all buyers, with the contractor to contact them personally regarding their wiring.

The sale price of a Glover home in the Thornwood development includes a basic wiring allowance. This usually runs about $700,

LIVE BETTER ELECTRICALLY
Thornwood SALES CO.
All Electric HOME
In Cooperation with THE DETROIT EDISON CO.
Developer GEORGE H. GLOVER, Inc. Phone MI 6-1900

W. Haller, Detroit Edison Co.; George H. Glover, George Glover, Inc.; Hubert Smith, Smith Brothers Electric, Inc.

When Your Plans Call For
FITTINGS & SWITCH BOXES
Specify
Arrolet CORPORATION

"Like money in the bank"—That's what estimators think about Arrolet's dependability when figuring job costs. Arrolet products have all the features you need to help keep installation time and costs under tight control. Here's a good example:

New! ARROLET
Bevel Corner
SWITCH BOX
3" x 2" x 2¼"
cat. no. 160-NGBR
Non-Gangable

Outstanding features of this box are the self-gauging notches for quick, accurate alignment with ½" and ⅜" walls. Only 2 nails needed to hold it securely in place.

Has 2 cable K.O.'s in each end and one ½" K.O. in bottom. 2 CRS non-metallic cable clamps. Projection welding gives BR bracket maximum strength.

Complete details about various mounting devices for the 160-NG series given in our New Product Sheet No. 2c.

For boxes, fittings and accessories that do the job best, make sure to specify 'ARROLET' in your next order.

FREE
WALL CHART—Box guide for maximum number of conductors. Quickly identifies boxes & covers.
Ask for Latest Catalog, Too. Write for Both, Today!

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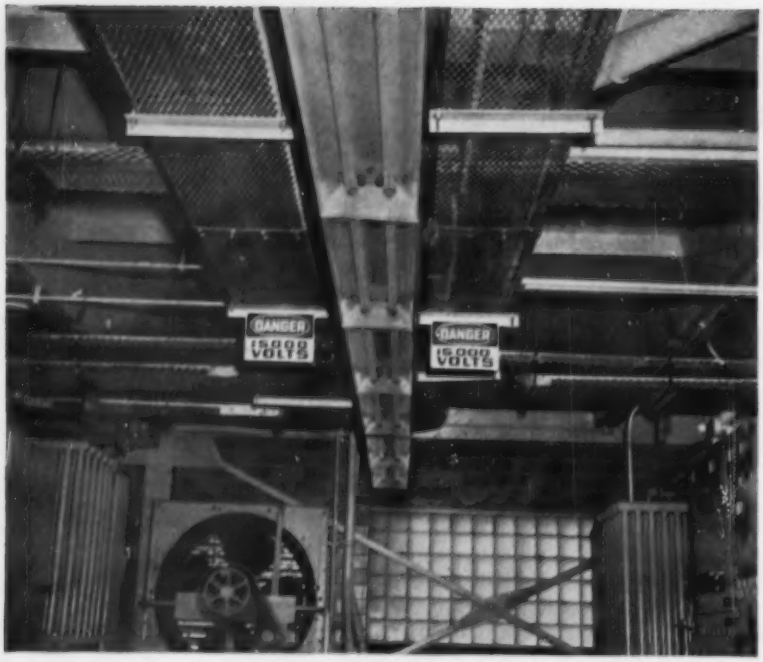
MONTGOMERY, PENNA.

Sales Representatives & *Warehouse Stocks
BALTIMORE, MD. • CHARLOTTE, N.C. • *CHICAGO, ILL. • *CINCINNATI, OHIO • *DENVER, COLO. • DALLAS, TEX. • *LOS ANGELES, CALIF. • *MIAMI, FLA. • NEW YORK, N.Y. • NEWTON CENTRE, MASS. • *PHILADELPHIA, PA. • ROCHESTER, N.Y.



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POWER UP with COPE

Paper mills are noted for their large use of power. Power engineers in the pulp and paper business know how to conserve materials and still guarantee long, trouble-free service. They can't afford a power breakdown.

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Tommy Cope says: **"Keep your voltage high with Cope. You'll keep your costs low."**

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Our engineers are ready to work with you. Write us today for full details on Cope Cable Supporting Systems.

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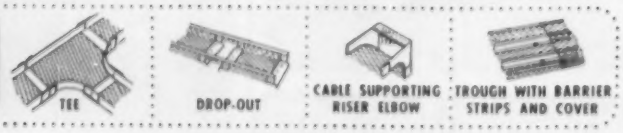

which is above the normal allowance for houses in this builder's $30-35,000 class. Glover agreed that the contractor was to work with this allowance, and that he would leave any additional electrical sales strictly to Smith Brothers Electric.

Once Hubert Smith is notified by Glover of a sale, he takes over. A form letter is sent to the buyer asking if he would like an appointment with the contractor to select switch and outlet locations. The major part of the letter, however, suggests additional items (such as dimmers, fire alarms, intercoms and garden lighting) which the owner might desire "in this day of electrical living." The recipient is urged to ask for more information on these items by checking an enclosed card; he then returns it, with his appointment request, to Smith Brothers Electric.

Hubert Smith has handled most of the appointments with buyers. He plans on about three hours per call, making his specific time of appointment by telephone or letter. Discussion at first, he says, usually centers around the placement of outlets, and then on lighting fixtures.

"It varies as to what comes next," Hubert Smith adds. "The customer often has something specific in mind; then I try to bring up other items. On costs, reactions are unpredictable. But certainly there's less resistance to added electrical items now than there was just a few years ago."

On the 175-home Thornwood project, he figures that the basic $700 wiring allowance is being upped to "near $1,000" by lighting fixtures and electrical extras. If this pace continues through the end of 1956, the contractor will have broken its record 1955 increase on billings for new-home wiring.

Billing on the average wiring job has jumped steeply since 1948. In 1948, Smith Brothers Electric records show that the average job sold for $135; the average today is $385 per home—and a good part of the credit belongs to the contractor for consistent up-selling.

Says George Smith: "We like the residential field, and think that there's opportunities in it for lots of contractors. Now that the national programs are rolling, there will be even more opportunities."

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or...How ABC Helps You Run The Magazine Business

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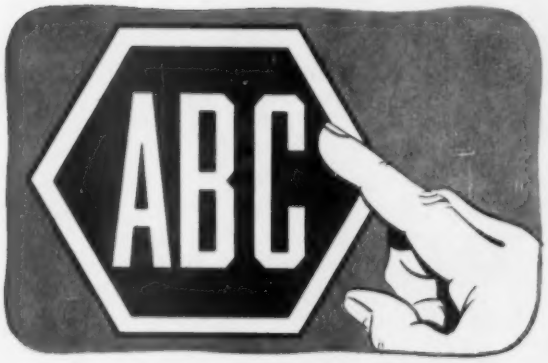

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In The News

Acute Problems Beset Contractors Amid Unprecedented Prosperity

Labor scarcity, management short-comings, unstable bidding, trade problems plague NECA contractors as prosperity and industry promotion reach unprecedented heights.

"The Need—Who Will Fill It?" was the question put to the members of the National Electrical Contractors Association at their 55th anniversary convention held September 26-29. More than 2,000 members and guests attended the convention and National Electrical Exposition held in the Civic Auditorium in San Francisco.

"What is this need?" President Oliver F. Burnett asked. "In the next 10 years we are going to need 15 million new homes in this country. And if you are building a million a year, in ten years you don't have 15 million. But every time you open up a new subdivision, people move into it faster than you can get them built. What happens then? People have to have some place to go to buy their groceries, food, drugs, etc. So the needs of commercial establishments are always great. We need schools. Even with the tremendous school building we have had in the past few years we are nowhere near up to the requirements for educational facilities.

"Our economy has become so dynamic that our industries are hard put to keep up with the desires and needs of the people with respect to the goods they want to buy. No one," Mr. Burnett said, "has been able to predict the industrial construction of this country accurately in the last five years. It has gone beyond everyone's expectation. Then you add to that the public works required, the utility expansion. It is now planned to double the present capacity for generating electricity in the next ten years.

SENATOR W. F. KNOWLAND addressed the NECA convention and discussed America's Foreign Policy. He is shown here with E. L. Buttner, Scott-Buttner Electric Co., Inc., Oakland, Calif.

"When you add it all up, the electrical contracting business each year for the next ten years is going to exceed by about 20% in value the highest construction period we have ever known.

"The need is there," Mr. Burnett continued. "To satisfy that need, it must be sold. I feel that we need to increase our perspective of what we exist for if we are going to be able to do this job. It is a tremendous undertaking."

Manpower Shortage

"I have heard a lot of people discuss the manpower shortage," Mr. Burnett continued, "and everyone seems to think that the national association should do something about it. We do business principally with the IBEW and, incidentally, I believe it is every man's right to do business the way he wants to; whether he wants to do business as a union contractor or not, that is his right.

"I also believe that it is every man's right, every employee's right to belong to a union or not as he sees fit. Though it is every man's right, we must recognize the fact that with the IBEW we have done the job, principally.

"The man who does the utility work and does the industrial work and the commercial work needs to have the residential work of this country organized. It is to his advantage. If he doesn't do it, he should see that someone does it, because we have this responsibility for the guarantee of the electrical wiring contract which we have assumed in this country, and we should assume it in all areas. Someone else will do it if we don't. And we are creating new groups of competitors that do not think the way we do.

"Your national office can do a great deal with the manpower shortage. They have done a fine job in laying the ground work, yet the major part of that job must be done at the local level. Good labor relations come only from hard work on the part of many individuals at the local level," Mr. Burnett said.

Below Cost Bidding

"As to the low-cost bidding problem, it seems to be paradoxical that in the time of our greatest

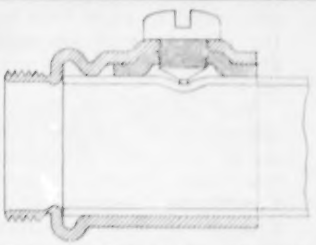
BENDING LOAD TEST SHOWS STRENGTH AND GRIP

of National Electric E. M.T. Fittings

Two lengths of ½" E.M.T. were joined with an NE coupling (all that was needed was a screwdriver) and cinder blocks weighing 54 lbs. were suspended from the joint. The entire assembly was then rolled along the supports with no effect on the coupling's efficiency . . . a convincing demonstration of the strength of the NE fittings. Especially since the Underwriters require only a thirty pound weight for this test.

National Electric E.M.T. connectors and couplings are safe and strong because of the sturdy one-piece pressed steel body and outstanding holding action of the patented NE embedding screw. The contact of the screw in the tubing wall constitutes a safe permanent ground. All fittings are galvanized for full protection against corrosion.

National Electric E.M.T. connectors and couplings are the easy way to assure a quality, uniform installation. Try them . . . they're sold by the leading electrical distributors everywhere.



The outstanding holding action and vibration resistance of National Electric Fittings are obtained when the tip of the patented screw is driven home and embedded in the tubing wall.

Patent No. 2,455,180

National Electric Products

PITTSBURGH, PA.

3 Plants • 10 Warehouses • 36 Sales Offices

BUSY PARTICIPANTS at the NECA Convention were R. W. McChesney, Harry Alexander, Inc., Washington, D. C., Oliver F. Burnett, Kelso-Burnett Electric Co., Chicago, president of NECA, and D. B. Clayton, Sr., Electric Constructors, Inc., Birmingham, Ala. Messrs. McChesney and Clayton are past-presidents of the association.

prosperity, contractors are still putting in bids of what we commonly call cost or below cost, and even contributing to our costs our own money to help them build their buildings.

"Managements generally are beginning to recognize that a man who does not make a profit is not of very much use to anybody. We need a new approach, new thinking. Some of the old fashioned ideas and attitudes have to go. You fellows have to want to lick that problem. Everyone of you has to help. It can be solved tomorrow morning if every man will say that henceforth, I will never put a price in on a job that does not contain a net profit," Mr. Burnett concluded.

Committee Reports

An intensive drive to secure enactment of fair bidding legislation, an expanded apprenticeship and training program to meet the manpower shortage, and continued emphasis on management training and market development were recommended as basic 1957 programs for the electrical contracting industry by the standing committees of NECA.

The reports were those of the Governmental Affairs Committee, A. B. Weinfeld, Columbus, Ohio, chairman; Business Development Committee, Arthur E. Bertke, Cincinnati, Ohio, chairman; Research Committee, Charles P. Bobe, St. Louis, Mo., chairman; Codes and Standards Committee, William H. Biester, Philadelphia, Pa., chairman; Line Construction Committee, C. W. Moseley, Charlotte, N. C., chairman; Labor Relations, Oliver F. Burnett, Chicago, chairman of the Executive Committee, who also reported on the Council on Industrial Relations; National Joint Apprenticeship and Training Committee, Fred J. Oertli, St. Louis, Mo., co-chairman; and a report on the National Employees Benefit Board by Paul M. Geary, Washington, co-chairman. Mr. Geary and Clint J. Harder submitted staff officer reports which showed the Association now has a membership of 3,622. Its financial position was reported as very satisfactory.

The Governmental Affairs Committee reported that the Federal Construction Contract Act failed by a narrow margin of final enactment by the last Congress. It was the unanimous recommendation of the Committee that NECA continue through the Council of Mechanical Specialty Contracting Industries to press for enactment by the 85th Congress of this measure or one of a very similar nature.

The Committee noted a growth trend toward arbitrary discrimination by government officers against small business subcontractors. A study of this situation is being made. The committee also reported that it was following closely the FHA study of the problem of "rapidly wasting" items, such as electrical appliances, in connection with federal guaranteed mortgages.

Business Development

The Business Development Committee reported that 1956 "can best be characterized as the year in which the NECA program became an inter-industry activity." The Committee recommended continuation of a modest advertising program in the national news magazines and in specific industry and trade publications and stepped-up market research and inter-industry relations.

The Research Committee reported that the Home Modernization Section of the Sales Training Course has been developed in cooperation with the EEI. It is proposed to publish this, together with a commercial and industrial modernization sales training course, as two separate sales training courses.

The Codes and Standards Committee reported that the 1956 edition of the National Electrical Code is being printed and copies should be available soon for this guide to be operative about January 1, 1957. The Committee urged that electrical qualification standards and compensation be raised.

The Line Construction Committee reported excellent progress in the program to organize line construction contractors into regional chapters of NECA. The report outlined this plan of organization, noting that charters already had been issued to five Line Construction chapters of NECA, and that a manager of the Line Construction Department had been employed to coordinate and direct this activity.

The report on Labor Relations noted that the basic principle of the Association's labor relations service is that of cooperation by labor and management with a high regard for each other's rights and for their mutual obligations to the public.

"We must recognize the fact that there is no legitimate place in this industry for either a so-called closed chapter or a closed union," the report stated, adding that the manpower problem . . . "requires continuous training of a force of new workers and of ever expanding training of those skilled workers already in the industry. It requires continuous attention, imaginative planning, and devotion to a mass of detail to carry on an adequate apprenticeship and training program."

The Council on Industrial Relations reported that in the past year it had heard and decided 53 cases, any one of which might have resulted in a serious strike. It called on the industry to bargain in good faith locally and explained some of its policies, including those on the Council clause and retroactive pay.

The National Joint Apprenticeship and Training Committee report noted that though the industry's apprenticeship program is

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Exploded view of new Delta-Star Type M-2 Control Switch shown above. Three of many types available shown at left.

Many types available including . . .

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Look, inspect and double-check—you'll see why Delta-Star's new Control Switches offer new features that mean vastly improved efficiency, economy and service:

1. **Versatile**—available for many uses; switches are rated 20 amps. continuous rating with 250 amp. short-time (3-second) rating.
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Adjustable Floor Boxes are Fireproof

All adjustable floor boxes are equipped with an insulated 14 strand copper wire which provides a positive electrical bond between exposed flush parts and conduit system, conforming to Underwriters specifications.
Once installed, wire cannot come in contact with exposed receptacle terminal screws inside box.

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Designed for telephone outlet or where permanent connections are made, or as a junction box.

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This new malleable iron clamp with a double safety bite of case hardened tool steel is cadmium plated to prevent rust.
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regarded as a model in the construction industry, it is not sufficient to meet today's demands for skilled manpower. In the year ended August, 1956, the 1,949 electrical journeymen who came into the industry were from 120 wage areas which have active Joint Apprenticeship Committees. There are approximately 500 wage areas in the country.

The National Employees Benefit Board reported that collections of the 1% assessment on labor payrolls to support the industry's pension plan continue to increase and that as of July 31, 1956, there were 11,336 contractors making these payments, covering 132,516 employees.

Maintenance of Automatic Controls

"The AFL-CIO Merger" was the topic assigned to Joseph D. Keenan, International Secretary, IBEW, Washington, D. C. Before discussing the merger, he pointed out that automation and the increased importance of electronic controls and computers have opened up a new era of operation for electrical contractors and particularly the maintenance of these control systems and computers. "There is a definite need for electrical contractors who can take this maintenance work under contract for one or more plants," he said.

"The stumbling block to the electric industry's ability to meet the new demand in industrial construction and electronic maintenance, will be the lack of engineers and adequately-trained craftsmen. There will be a need for construction electricians who have a general working knowledge of the electronic computer, which is the heart of any automation process. In the field of apprenticeship and training," he advised, "our industry is going to be faced with challenges that have to be met, not only in the future but right now. The impact of automation and atomic energy is resulting in a greater demand for more skilled men with a higher degree of skill than ever required before. At the present time the construction industry is adding only 15 new craftsmen for every 17 they lose yearly. Not only is it failing to meet today's needs, but it is failing to keep abreast of rapid changes in new industries, new materials, new methods and new techniques.

"There is also the imperative problem of retraining journeymen," Mr. Keenan said, "so they can meet the new skill demands and adjustments required in today's automatic industries where electronics will play so large a part.

"What is happening to residential building? Home building has dropped off 20% since last year. There are several reasons why this has happened. The tight money market is the biggest contributing factor. We should be concerned about this," Mr. Keenan said, "because the first sign of trouble in the construction industry always shows up in the residential field. This segment of the industry is beginning to crack now. Let's keep in mind the fact that the modern home of today uses as much energy as a small factory or commercial building did a few years ago. It is not a market to ignore.

"NECA contractors have ignored residential work for the most part," he said. "A recent questionnaire sent out to electrical contractors on the East Coast regarding home modernization work revealed that all of those who answered were non-union contractors. Selective bidding practices, that is, refusal to bid on residential wiring, has done more to develop non-union competitors than anything else.

"It is in the residential field that the small, non-union contractor gets his start. If he can make good here," Mr. Keenan continued, "his next step will be to compete with you people on larger jobs. Home modernization programs must be developed and guided by local unions and local NECA chapters. If we cannot control such a program, many evils will develop.

"What has happened in the area of jurisdictional disputes over construction work in industrial plants? The principles incorporated in the merger agreement guarantee that each affiliate will retain the status, jurisdiction and bargaining relationship it had before the merger. This is a fundamental basis of the merger, and no charter or officer of affiliation granted by the AFL-CIO will be changed," said Mr. Keenan.

Public Relations

The story of public relations was presented by a panel discussion entitled "Does Your Public Like You?". George B. Roscoe, NECA public relations director was the discussion leader and participating in the program were Whitworth Ferguson, Ferguson Electric Construction Co., Buffalo, N. Y.; B. P. Water, White Electrical Construction Co., Columbus, Ga.; J. D.

O'Connor, Luppen & Hawley, Inc., Sacramento, Calif.; Davis H. Elliot, Davis H. Elliot Co., Inc., Roanoke, Va.; and Donald Larson, manager, Rocky Mountain Chapter, NECA, Denver, Colo.

Industry Promotion

"The Industry Goes to Market" session was conducted by P. Howard Farley, director, NECA Marketing Service, Washington, D. C. The various industry promotion programs were described and illustrated by slides. John S. C. Ross, manager, Residential Sales, Pacific Gas & Electric Co., San Francisco, covered Housepower; R. E. Ingmire, manager, Inter-Industry Activities, New York City, outlined the program of Live Better Electrically—1957 Plans; John F. Biggi, manager, National Adequate Wiring Bureau, New York City, showed the material prepared by the Bureau and discussed the promotion for commercial sales. A. E. Bertke, chairman, NECA Business Development Committee, Cincinnati, Ohio, gave a report on the progress made in 1956 and Norvell Ogden, Power Electric Co., Jackson, Miss., discussed the marketing plans for 1957.

Arthur W. Hooper, executive director, National Association of Electrical Distributors, New York City, presented a challenging report on wholesaler-contractor relations in "As We See the Industry."

"The one missing element is an aggressive organization at the working level to do an industry job. That," he said, "is the challenge facing contractors and wholesalers in the electrical industry today.

"This industry is spending about $10 million to motivate people to get interested in the housepower in their homes, so that they will have sufficient service and wiring to live better electrically.

"Unless we—contractors and wholesalers—recognize the challenge here," Mr. Hooper said, "we may wind up in the unhappy position of being responsible for the electrical industry falling into one of the oldest merchandising traps—the advertising of a product or service that isn't readily available. We should not confuse the picture by indicating so little understanding and recognition of our own respective responsibilities in the electrical trade channel.

"How far are we going to get unless there is a professional organization actively interested in the program, so that the goods are

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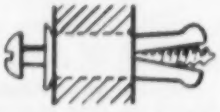
EASIEST OF ALL WOOD SCREW ANCHORS TO INSTALL. Takes screw sizes #4 to #9.

FOR USE IN BRICK, CEMENT, CONCRETE, TILE, WALLBOARD, WOOD, METAL, ETC.

FOR PERMANENT RUST PROOF INSTALLATION

These ANCHORS are ideal for mounting such articles as FIXTURES and General Equipment around the Office, Factory, and Home.



INSTALLATION OF U.S.E. GENERAL PURPOSE ANCHOR IS EASY

Drill hole, as recommended in wall where fixture is to be mounted.

Insert anchor in hole, and place fixture, insert screw and tighten.

The tough plastic anchor expands under pressure when screw is tightened, making a secure installation.

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sold and installed properly," asked Mr. Hooper.

"Why are the distributors a part of it? If production and promotion are going to have results, it is going to need a professional job of wholesale distribution.

"If the contractor is going to be able to accomplish his part of this program he must have some of the following services readily available to him at a reasonable cost. There must be a warehousing job done. The contractor may or may not undertake to do an all-out selling job. In the event that he does—as he should—he is going to require some sales counsel from a central, local source. In some instances technical information will be needed. Certainly he is going to require some reasonable extension of credit in handling this work. He is going to want a local organization available to him for handling claims, credits, shortages, for following up on orders for special materials, and for delivering those materials promptly to the job. That's the distributor's part," said Mr. Hooper.

"The time has come when we must cease stumbling over each other and learn to work together for the good of the industry. Let's stop fighting the problems and instead take steps to correct them," he urged. One of the first steps to be taken in a positive approach is to recognize that each branch of this industry is necessary to the total effort.

"The wholesaler remains with us because he performs a vitally necessary service—the service of collecting, storing and distributing goods with the least possible waste of time, space and manpower. Thus, as long—and only as long—as the wholesaler is able and willing to perform functions—functions that cannot be eliminated—more efficiently and more economically—he cannot be replaced," Mr. Hooper concluded.

Amendments and Resolution

A constitutional amendment authorizing the Association to establish Branches as well as to charter Chapters, was postponed for another year to allow the committee and membership to study it further.

Resolutions passed called for:

NECA headquarters and IBEW to help contractors meet public needs with special reference to modernization work and the supply of skilled labor.

Suppliers to discontinue material take-off from plans and confine quotation to specific materials as requested.

Enlisting cooperation of other trades and AFL-CIO to eliminate work stoppages in jurisdictional disputes.

Corrective legislative action on retained percentages and contractor payments.

Western Inspectors Preview Code Changes

A preview of significant changes appearing in the 1956 National Electrical Code, a review of electrical industry national promotional and advertising campaign geared to better electrical living and an exchange of field problems and experiences highlighted the 52nd annual conference of the Western Section, International Association of Electrical Inspectors. More than 450 members and guests journeyed to St. Louis, Mo., for the 3-day meeting.

In his opening address, Western Section president Glenn Rowell, Minneapolis, pictured the electrical inspector as the Keystone of the Electrical Industry. But, he must truly serve the people and not himself or some segment of the industry. Rowell defined a good electrical inspector as one who is neither a policeman nor an umpire, but is instead a diplomatic educator and salesman—in fact, the best ambassador the electrical industry has with the buying public. Questionable provisions in local laws and ordinances which benefit a part of the industry are a reflection on the whole industry, he continued. Today, there are more homes than ever before with seriously dangerous electrical installa-

NEW PRESIDENT of the Western Section, IAEI, R. L. Thompson (left), Albuquerque, N. M., receives gavel from retiring president Glenn Rowell, Minneapolis, at recent Western Section conference in St. Louis, Mo. Gavel was made by R. C. Loughhead, Michigan Inspection Bureau, Detroit.

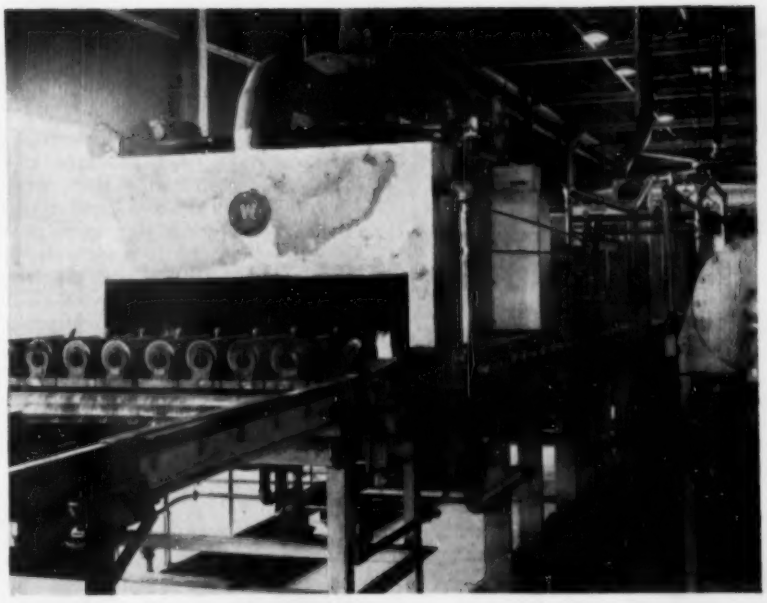
tions. We must get behind any program which will correct these conditions and give the public everything they need to assure safe and adequate use of electrical energy at a cost within reason. What we need today are not "show installations" but more new circuits, more outlets and larger services, replacement of defective and worn-out materials, devices and appliances with due respect to the owner's pocketbook, Rowell concluded.

International President L. O. Trim, Burbank, Calif., reported a total IAEI membership of more than 9,000, including a gain of some 3,250 during the past two years. More Type F (municipality) memberships were urged. In a number of states, inspectors are serving with manufacturer and utility representatives on special committees acting in an advisory capacity on pertinent legislation. More of this type of cooperative activity was recommended. At the conclusion of his report, President Trim presented IAEI Honorary Life Memberships to Earl M. Nelson, National Electrical Products Corp., Chicago; S. R. Todd, electrical inspection department, City of Chicago; and D. J. Talbot, retired chief electrical inspector of Chicago.

Progress reports on National Electrical Week, originated by electrical inspector groups, were presented by S. R. Todd, Chicago and M. E. Skinner, vice president, Union Electric Co., St. Louis. The support of electrical manufacturers was outlined and the part of the electrical inspector in sparking local community activity in support of the promotion was emphasized.

A. W. Peterson, regional manager, Live Better Electrically project, St. Louis, outlined this unified electrical industry program to increase the electrical standard of living of the American public. J. R. Furber, Northern States Power Company, Minneapolis, gave an outline of the objectives and operation of the Housepower Program—a promotion directed primarily to the rewiring of existing homes. Prime goal of the program, one phase of the Live Better Electrically concept, is to get at least 20 million American homes rewired in the next ten years.

An insight into the basic reasons for and the procedures followed in conducting the fact-finding Investigation of Conduit Fill was presented informally by Karl S. Geiges, chief engineer, Under-

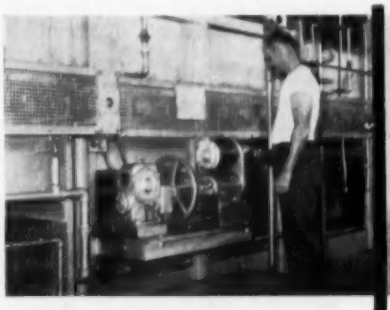


How does ONAN Emergency Electricity protect this electric roller hearth furnace?

This furnace operates at 1400° F. Inside are a series of steel rollers driven by an electric motor, which turn at low speed and move pallets loaded with metal parts through the furnace. If these rollers should stop turning for as short a period as 5 minutes . . . deformation will occur and the rollers must be replaced. This is a very costly repair.

To guard against this loss and to keep the furnace operating, the company installed an Onan 3,500-watt emergency electric plant with completely automatic controls. Now . . . if regular service is interrupted, the plant starts automatically and takes over the power load. It keeps the 3½ H.P. electric motors running and supplies 1,000 watts for emergency lighting.

Where an industrial process cannot be interrupted without serious loss . . . an Onan Emergency Electric Plant may pay its entire cost several times a year. Ask your consulting engineer, or electrical contractor about Onan Standby Power . . . or write us for information.



This is one of the electric motors on the emergency power circuit. Power is transmitted through the gear reducer in the foreground to drive furnace rollers at very low speed.

The Onan 3,500-watt emergency plant is installed in the plant 300 feet from the furnace. Automatic start and stop control is located near the furnace.

WRITE FOR FOLDER ON EMERGENCY POWER

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

2920 UNIVERSITY AVENUE S.E., MINNEAPOLIS 14, MINNESOTA

They Won't Come Out Because...

ALL
TUBE-WELD
FITTINGS' SCREWS
ARE STAKED FOR PERMANENCE!

With Tube-weld's oversized hardened steel set screws, you'll eliminate fumbling and costly waste of time when working in high or tight places. This, plus longer length for easy wire-pulling, heavy gauge *one piece* construction that cannot open or spread, self-centering box connector shoulders, lustrous zinc finish and easy-to-locate packaging are just *some* of Tube-weld's features. Available in ½", ¾" and 1" sizes. Brochure on request. ***ELECTRIC TUBE PRODUCTS, (A Subsidiary of Berger Machine Products, Inc.) Plant & Offices: 74-16 Grand Ave., Maspeth (N.Y.C.), N.Y., DEfender 5-8000.***

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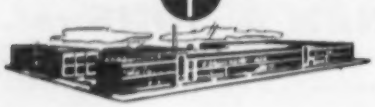
CONNECT WITH ETP FOR ECONOMY



writers' Laboratories, Chicago. The investigation centered around two main points: a study of conductor heating when more than nine conductors are installed in steel raceways; and a pull test to determine what happens to conductors and insulation when more than nine wires are pulled in a conduit or raceway. Results of the investigation may well lead to modifications in succeeding editions of the National Electrical Code—probably in the form of Interim Amendments to the new Code.

William Hogan, Jr., Chief Electrical Inspector of Chicago, reported on the 480-volt, 3-phase distribution technique tried in Chicago to increase capacity of existing apartment house wiring systems.

A preview of major changes in the 1956 National Electrical Code was given the inspectors by Charles L. Smith, secretary, NFPA National Electrical Code Committee, and committee members. Using the NEMA Analysis of Code Changes compiled by H. P. Michener, registrants followed a run-down section by section. Most of the 100-odd changes in the new Code are of an editorial nature designed to clarify the intent of many rules and make the code easier to understand.

Business Session

At the annual business session, the membership approved revision of the Western Section By-Laws to conform to the IAEI By-Laws; heard that Section membership was increased by some 425 this year as of the last day of the meeting. E. F. Cogan, of the IAEI office, reported that in the future membership directories will be published every two years with interim changes noted in the News Bulletin. Three Sections are now arranging annual meeting dates through 1961; and a subtechnical committee of the correlating committee is now studying the problem of built-in electric ranges, he advised.

New Western Section, IAEI officers elected at the closing session include the following: President—R. L. Thompson, Albuquerque, N. M.; first vice-president—E. H. Rueppel, Louisville, Ky.; second vice-president—L. S. Crain, Lincoln, Nebr.; secretary-treasurer—H. L. Parks, Charleston, W. Virginia. Members of of the Western Section Executive Committee include: W. E. Stewart, St. Louis; W. P. Hogan, Jr., Chicago; Chester B. Tressel, Canton, Ohio; Lloyd W. Roper, Council Bluffs, Iowa; L. E. Peterson, Sycamore, Ill.; R. S. Davis, Detroit; and Glenn Rowell, Minneapolis.

Representing the Western Section on the International Executive Council are: S. R. Todd, Chicago; George C. Monroe, Springfield, Mo.; H. L. Parks, Charleston, W. Va.; and R. C. Loughead, Detroit.

The next annual meeting of the Western Section will be held in Chicago during September 1957.

H. J. Vorzimer Appointed Director Electrical Equipment Division BDSA

Federal Pacific Electric Company of Newark, N. J., has granted a leave of absence to Harold J. Vorzimer, vice president, so that he may assume the duties of director, Electrical Equipment Section, Business and Defense Services Administration, Department of Commerce, Washington, D. C.

FARM WIRING PROBLEMS and how to solve them form topical discussion of these electrical contractors (L to R) J. C. Snyder and O. A. Solem, Clark Lark, Mich.; W. J. Spinabella, Mountain Grove, Mo.; E. B. Oberlander, Peoria, Ill.; I. Joslyn, Minneapolis, Minn.; and F. E. Keith, Des Moines, Iowa.

HAROLD J. VORZIMER

Mr. Vorzimer's career in the electrical industry began in 1918 when he was a co-founder, with Louis W. Cole, of the Cole Metal Products Company, one of the predecessor companies that were formed into Federal Electric Products Company, and in 1953, Federal Pacific Electric Co. For many years he headed the Long Island City division which manufactures panelboards, switchboards and many special devices.

In 1946 Mr. Vorzimer was one of the first in a group of 55 industrialists selected by the late Secretary Forrestal for a Navy orientation course conducted at Columbia University.

Eastern Inspectors Analyze Code Revisions

The 32nd annual meeting of the IAEI's Eastern Section—held this year at the Wentworth-by-the-Sea Hotel in Portsmouth, N. H., October 15-17—was attended and enthusiastically endorsed by over 400 electrical inspectors, contractors and manufacturers.

As usual, the Code was the No. 1 topic of the meeting; being discussed seriously and analytically at three Code Breakfasts and the major portion of five business assemblies. These discussions covered an extensive range of Code sections; including such topics as wiring methods and conductors, feeders and service entrances, grounding and overcurrent protection, motors and controllers, transformers and vaults, buses and raceways, branch circuits and switches, hazardous locations and emergency systems. In all of these

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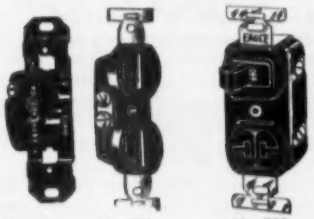
THE MOST COMPLETE LINE OF QUALITY ELECTRICAL WIRING DEVICES

The "1" Line That Offers More . . .

- COMPLETENESS—one purchase order, one shipment, one invoice, better stock control saves time and reduces handling costs.
- LOW COST—Eagle's 4 plants basically produce all materials, keeping costs down and allowing you a greater profit margin.
- EFFECTIVE MERCHANDISING—Eagle products are smartly packaged and clearly marked for easy identification and quicker handling.
- QUALITY—for over 35 years Eagle has been identified as the quality wiring device line, at competitive prices. You'll eliminate service call backs because of Eagle's outstanding record of TROUBLE FREE performance.

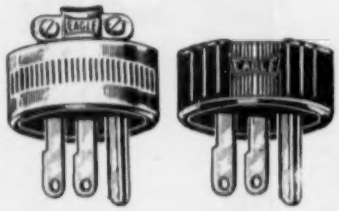
SWITCHES and RECEPTACLES



No. 787 Toggle Switch — No. 736 Duplex Receptacle — No. 798 Combination Switch and Receptacle

(With screws mounted on straps)

3 WIRE "U" BLADE DEVICES



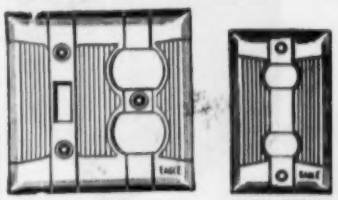
No. 867 Parallel Ground Armored Cap — No. 847 Parallel Ground Bakelite Cap

INTERCHANGE DEVICES

Interchangeable With All Standard Lines

No. 901 Single Pole Switch — No. 902 Power Receptacle

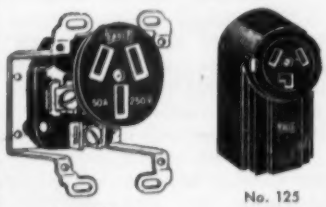
EAGALINE and INTERCHANGE PLATES



No. 138 Combination Plate — No. 952 2 Device Plate

RANGE and DRYER RECEPTACLES

FLUSH & SURFACE TYPE



No. 122 Range Receptacle — No. 125 Dryer Receptacle

EAGALOK DEVICES

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No. 873 3 Wire Cap — No. 893 3 Wire Connector

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KARL S. GEIGES, chief engineer, Underwriters' Laboratories, Inc., Chicago, gives electrical inspectors at Western Section, IAEI conference a brief outline of procedure used in fact-finding investigation of conduit fill carried out in the U. L. labs in Chicago.

talks, new, revised or refined definitions were thoroughly examined for intent and purpose; the thinking of Code correlating committees was explained and examples of application were related to new products on the market, new methods of wiring, new installation tools and other similarly pertinent factors.

Armand D'Angelo, Deputy Commissioner, Dept. of Water Supply, Gas & Electricity, City of N. Y., stressed the "Importance of Electrical Inspection" and stated that 10,000 people lost their lives in fires during 1955 and that resultant property damage exceeded $885-million. Fortunately, only small percentages of these losses were directly related to electrical causes, yet all-too-many cases existed where the losses were the result of poor wiring methods, improper grounding, inadequate insulation, overloaded circuits and improper methods of control.

During the past quarter-century, the number of electrical appliances available to home-owners has jumped from 8 to 57, D'Angelo mentioned, yet wiring has not kept pace with this progressive record. Installing additional appliances has increased the convenience and comfort of modern living, he concluded, but it has also greatly increased the electrical load on old circuits and has multiplied the danger factor even in so-called "modern" homes that are still electrically antique.

This trend in residential electrification received attention, likewise, from Charles L. Smith, Sec.-Treas. IAEI; E. A. Brand, member of EEI's Wiring Promotion Committee and New Business manager of Niagara Mohawk's western division, and John W. Muse, New England promotional manager for the Federal Pacific Electric Co.

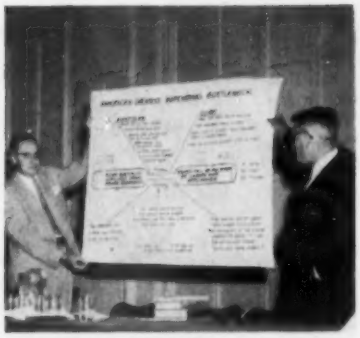
The public should be educated as to the great possibilities of electrical living, said Smith, but it should also be informed of possible dangers when modern wiring is not considered simultaneously. One step towards this educational objective is being taken by a NEW program (National Electrical Week, February 10-16, 1957), he continued; mentioning innumerable ways by which all branches of industry are participating in this program at the local and national level. The IAEI is solidly behind this movement, he summarized, stating that the international office is distributing a wide variety of promotional suggestions and materials to all of the association's local secretaries. E. A. Brand also told "How To Live Better Electrically With Full Housepower", citing the numerous programs that are being currently directed to homeowners, and stressing the importance of a 100-amp service entrance or better.

Relations between electrical contractors and inspectors was the subject of an interesting discussion by E. R. Cornish, Research Director of NECA, who stated that definite progress is being noted in the contractor's increased acceptance of responsibility for quality workmanship, cooperation with inspectors and concern with interpretations of the national code.

John Hager Elected President

At the final business session, John W. Hager, New York City, was unanimously elected as president of the Eastern Section for the coming year; with E. B. Fetty, Washington, D. C.; Clifton Clark, Windsor, Conn.; H. L. Schaefer, Closter, N. J., and G. J. Bostley, Rensselaer, N. Y., serving as 1st, 2nd, 3rd and 4th vice presidents, respectively.

Those elected as members of the executive committee for the 1956-57 season included B. F. Greene, J. D. Lynett and J. D. O'Connell, all from New York City; H. A. Brown and B. A. McDonald from Rochester, N. Y.; A. Angelo from Flushing, N. Y.; C. A. Berlepsch, New Haven, Conn.; M. C. O'Rourke, Waterbury, Conn.; B. B. Whelan, West Roxbury,



WIRING BOTTLENECK poster is part of safe wiring campaign being waged in Ft. Wayne, Ind. by chief electrical inspector A. H. Welklin (right). In addition to masterminding local promotion, Welklin is chairman of the Western Section, IAEI Publicity Committee.

Mass., and G. H. Shardien from Elizabeth, N. J. Those who will serve as members of the executive council include P. J. Hicks and Secretary J. W. King from Providence, R. I., and Frank Stetka of Washington, D. C., with J. W. Hager and J. D. Lynett as alternates.

In the annual reports of the Eastern Section's president George H. Schardien, City of Elizabeth, N. J.; and sec.-treas. John W. King, Providence, R. I., specific tribute was paid to the N. J. Chapter for having prepared a set of revised by-laws which (having already received the approval of the International office and Executive Council of IAEI) could well serve as a model for other chapters faced with the similar necessity for revision. It was also mentioned that the Eastern Section now has over 2500 members; 700 of whom are actively employed inspectors.

Code Changes Analyzed

Code changes and interpretations were discussed by Merwin Brandon, Chairman, Elec. Sect., NFPA, and v.p., Underwriters Laboratories, Inc.; H. H. Watson, General Electric Co., Chair. Code Making Panel 2 (Art. 200, 210, 220 and 700) NFPA; R. L. Lloyd, Engineer, U. S. Dept. of Commerce, Nat. Bureau of Standards, Chair. Code Making Panel 4 (Art. 240); S. J. Rosch, Consulting Cable Eng., Anaconda Wire & Cable Co., Member of Code Making Panel 6 (Art. 300, 310); L. S. Inskip, Protection Eng., Bell Laboratories, Inc., Chair. Code Making Panel 5 (Art. 250, 280); Walter O. Zervas, Research Eng.,

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American Iron & Steel Institute, N. Y., Member of Code Making Panel 8 (Chaps, 346, 348, 350, 351, 354, 362, 364); C. A. Badeau, vice president, Thomas & Betts Co., Member of Codes and Standards Comm. of NEMA, and Howard T. Michener, Asst. Mgr., Engineering & Safety Regulations Dept. of NEMA. These men, in addition to discussing Code changes, also covered Overcurrent Protection of Circuits (Lloyd), Trends and their Effect on Our Industry (Rosch), Developments in Steel Wiring Systems (Zervas), Fittings and Connectors (Badeau), and The 1956 Code Revisions from the Manufacturers' Viewpoint (Michener). All talks were followed by lively floor discussions and extensive question-answer periods.

League Managers Preview '57 Plans Elect Rosenthal

Managers and representatives of 30 electrical leagues, industry associates and guests of the International Association of Electrical Leagues heard reviews and previews of national industry programs, exchanged views and ideas on current league activities and elected officers for the coming year at the 21st annual conference of IAEL in Detroit, October 3-6.

For the Electrical Industry Coordinating Group, J. Reed Hartman, chairman, told of the harmony in plans and objectives achieved through the cooperative spirit prevailing between the branches of the industry.

Merrill E. Skinner, chairman of National Electrical Week presented the latest information on this industry program. L. E. Barrett, past president of the National Association of Electrical Distributors spoke on the topic "Put The Distributor on Your First Team."

Emerson P. Schmidt, director of the Economic Research Department of the Chamber of Commerce, reviewed the economic climate to which next year's sales promotion activities should be geared. Clarke V. Kirby, Frigidaire Sales Corporation, presented a forecast of trends in the development of kitchen appliances, and Robert E. Boian, manager of the Live Better Electrically project, told how electrical leagues are tieing in with this all-industry promotion of appliances and wiring.

Other speakers dealing with

sales and sales promotional topics included Owen Klepper, sales promotion manager of the Appliance Division, Philco Corporation; J. B. "Kip" Anger, national radio sales manager, Motorola, Inc.; Ver Lynn Sprague, Amana Refrigeration, Inc.; and Edward J. Hegarty, director of training services, Westinghouse Electric Corp.

C. T. Bremicker, chairman of the National Adequate Wiring Bureau and Milton I. Allen, vice-chairman of the Wiring Promotion Committee of the Edison Electric Institute, summarized the latest developments in the national programs concerned with residential wiring. In addition, Jack W. Kerr, chairman of the Adequate Wiring Committee of CEMA, discussed Canada's adequate wiring problem.

"How the Utilities Should Approach Selective Selling" was the title of a presentation given by Edwin Vennard, vice-president and managing director, Edison Electric Institute. Roy W. Johnson, executive vice-president of the General Electric Company, painted a picture of the broad approach to the development of the residential market, emphasizing especially a closer link with ACTION.

League members themselves took the floor for a panel discussion on Friday morning which provided a comparative analysis of the different procedures used in league organization and operation in their respective area. The panel consisted of J. Clark Chamberlain, San Diego; C. C. Simpson, Chicago; A. H. Kessler, Minneapolis; Don E. Rosenthal, St. Louis; Day Hacke, Omaha; William Freudigman, Providence, and Paul J. McMillan, Chattanooga.

The annual award of a plaque for the most outstanding activity of an electrical league in promoting electrical housewares during the past 12 months, was presented at the annual banquet to J. Clark Chamberlain in recognition of the program conducted by the Bureau of Home Appliances of San Diego County. This is the second successive year in which San Diego has won this award. The presentation was made by Don Alfred, manager of the Electric Blanket Mill, Fieldcrest Mills, Inc., in his capacity as chairman of the Electric Housewares Section of NEMA.

At the Business Session on October 6, officers and members of the Board of Governors were elected for the coming 12-month period as follows: President—Don E. Rosenthal, St. Louis; vice-presi-

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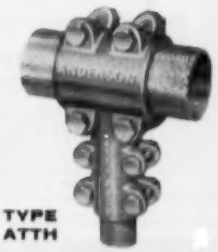

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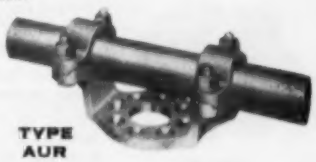

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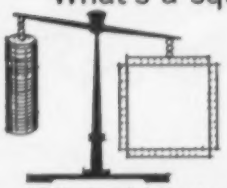

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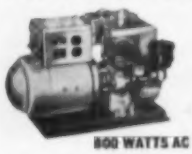

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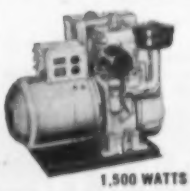

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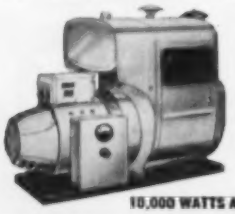

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dent—Glen L. Logan, Los Angeles; treasurer—John S. McDermott, Kansas City; Secretary—A. H. Kessler, Minneapolis. John Biggi, manager of the Business Development Department of NEMA was reappointed corresponding secretary.

Michigan Gets New State Licensing Law

Licensing of electrical contractors and electrical journeymen is now required by law in the State of Michigan. On August 11, 1956, a new law went into effect designed to "safeguard persons and property; to provide for licensing of electricians and electrical contractors and the inspection of electrical wiring; to create an electrical administrative board; . . . and to prescribe penalties for violations of the provisions of this act."

Known as Act No. 217, Public Acts of 1956, the new law sets up these three classes of licenses and *maximum* annual fees:

1. Electrical Contractor (employing journeymen) —$50
2. Independent Electrical Contractor (no journeymen electricians employed) —$10
3. Journeyman —$ 2

All wiring installed must be in conformity with not less than the minimum standards prescribed by the 1953 National Electrical Code.

Under the act, any village, city or township may adopt an ordinance providing for minimum standards of electrical wiring and licensing of electrical contractors and journeymen within its jurisdiction. However, a contractor so licensed must be deemed licensed as an electrical contractor in every village, city or township in the state and shall not be required to pay any license or fee of any kind other than that paid to his own municipality. Thus, cities and towns with established electrical and licensing ordinances can operate as they have in the past and their licensed contractors can operate anywhere in the state. Conversely, contractors coming into these areas from other parts of the state, must either have been licensed by their own municipalities or by the state.

In effect, this provision of the new law adds legal status to a voluntary reciprocity system in effect

for some years around the Detroit area. Under this system some 97 municipalities within about a 40-mile radius of Detroit honored each other's licensing requirements and accepted "registration" of contractors from municipalities in the group. Code rules in the areas were essentially the same and license fees were pegged at $25. By paying only the license fee in his own city, the electrical contractor could operate in any of the other 96 municipalities under the reciprocity system. Now this system is extended throughout the state of Michigan. Nominal $1.00 registration charges might be asked of contractors by individual municipalities.

The new law also permits the "board" to appoint the electrical inspectors having at least the same qualifications required for a journeyman's license. As yet, no state inspectors have been appointed.

According to the provisions of the act, violators will be guilty of a misdemeanor and subject to suspension of their licenses and a fine ranging from $10 to $100. Only the "board" can reverse a conviction or reinstate a license.

Under the law, the Electrical Administrative Board of the State of Michigan consists of the Commissioner of the Michigan State Police, or his duly authorized representative, and 7 other members appointed by the Governor with the advice and consent of the Senate. These other members represent an insurance inspection bureau, utility, electrical contractor, supervising master electrician, journeyman electrician, chief electrical inspector of a municipality and a manufacturer's representative.

The Board may fix fees, appoint state electrical inspectors, inspect wiring and its installation, grant annual licenses and certificates to qualified applicants, make all orders, rules and regulations necessay to the enforcement and carrying out of the provisions of the act.

Ray E. Rider, chief electrical inspector of Dearborn, Mich., and past-chairman of the Reciprocal Licensing Council in Michigan, is chairman of the new Electrical Administrative Board. Representing the electrical contractors on the Board is Fred J. Somes, Jr., president of Motor City Electric Company, Detroit. Other members include: Mrs. Mildred Weisinger, partner, Modern Wholesale Electric Co., East Lansing; John T. Wil-

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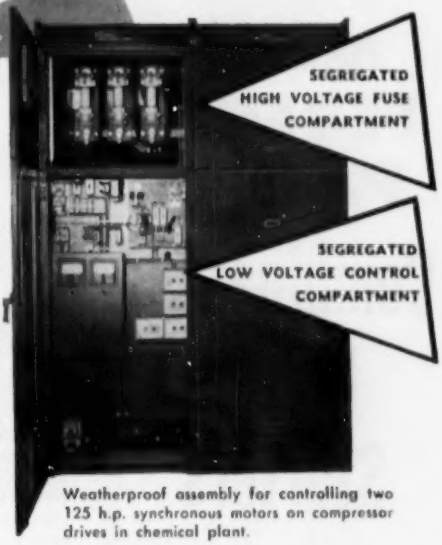

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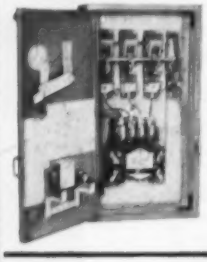

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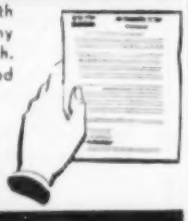

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liamson, sec'y-treas. Michigan State Conference of Electrical Workers, Charlotte; George D. Stevens, Consumers Power Company, Jackson; Ralph M. Stouffer, president, Stouffer-Frick Electric Co., Benton Harbor; and Clinton B. Fitch, manager, Mill and Elevator Dept., Michigan Millers Mutual Insurance Co., Lansing.

Urge Local Tie-in With Electrical Week

Promotions on television and radio, aimed at attracting a large national audience, are only the first step in making National Electrical Week successful. Local promotions must carry this industry-wide promotion through, according to NEW Chairman M. E. Skinner.

The need for local action—on top of the many manufacturer tie-ins which have been set nationally—was stressed by Skinner, vice president of the Union Electric Co., before the International Association of Electrical Leagues, meeting in Detroit. The second annual Week observance is set for Feb. 10-16, 1957.

"We don't have a captive audience," Skinner added, "nor do we have a foolproof way of attracting or holding our audience's attention during such a national event. Small local programs should be planned, even if a full-scale observance isn't possible."

A planning kit for local use is now available. Provided by the national committee, it includes news releases, radio spots and display suggestions.

Skinner suggested that the first step in the use of the kit was the organization of local committees, made up of representatives from all segments of the industry. Among the activities which local groups can launch are utility open houses, league NEW luncheons and inspector groups' use of home electrical inspections reports in schools. Skinner said that efforts should be made to cooperate with schools and local officials, who are often eager to participate in such programs.

Network TV and radio shows are high on the list of national promotions being set by manufacturers. Participants now include General Electric, Westinghouse, Allis-Chalmers, DuPont, Reynolds Metal, Motorola, Zenith and others. Many manufacturers, it is reported, are setting up open houses for employees and customers, and some

are considering new product announcements during the Week.

Live Better Electrically is now scheduling its semi-annual promotion to start in conjunction with the Week, probably on Jan. 30. LBE's campaign will be kicked off by a national closed circuit telecast aimed at the electric industry, and will be sponsored by local utilities at about 70 locations.

The Week has obtained a ninth major sponsor. The International Brotherhood of Electrical Workers is giving its support to NEW, Gordon M. Freeman, international president, has announced.

NISA News

A program of medical and surgical group insurance to supplement the present NISA group life insurance was approved by NISA's Executive Committee meeting in Niagara Falls, Ont., September 17. The Association's group life insurance was inaugurated in the spring of 1955 and has been enthusiastically received by the NISA membership.

• • • •

The Executive Committee engaged Joseph Harrington, manager of the Iowa NECA Chapter, as a staff assistant to Executive Secretary Fred B. Wipperman. The Association also plans to appoint a new staff engineer to replace Raymond E. Wilson whose resignation was accepted by the Committee.

• • • •

New officers of the NISA Southwestern Chapter, elected at the chapter's meeting September 20-22 in Oklahoma City, are: president, Ray Horton, Daley Electric Co., Phoenix, Arizona; 1st vice-president, V. A. (Dick) Bradley of Bradley's Motor & Armature Works, Corpus Christi, Texas; 2nd vice-president, George Kinard of Electric Motor & Repair, Beaumont, Texas. Jim Morgan of Central Electric Co., Fort Worth, Texas, was re-elected secretary-treasurer.

New directors of the chapter include: J. A. Phares of Southwest Electric Co., Oklahoma City, Okla.; O. H. Caldwell of Caldwell Electric, Waco, Texas; Herschel Wooley of Houston Armature Works, Houston, Texas; Henry T. Poulen of Poulen's Electric Co., Monroe, La.; and Bob Clark of Brandon & Clark Electric Co., Lubbock, Texas.

• • • •

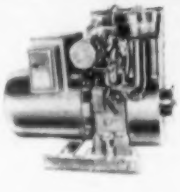
NISA Director John M. Young of Anderson Young Electric Co., Lubbock, Texas, told the meeting

TORK
time switches
Precision timing FROM 40 BELOW ZERO
35 Ampere INCANDESCENT LAMP LOAD RATING
Astronomic timing AT A PRICE YOU CAN AFFORD
WRITE NOW•• FOR COMPLETE DETAILS
TORK
MOUNT VERNON, NEW YORK

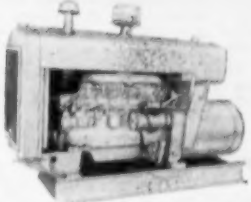
NOW the industry's newest models.... at today's most inviting prices!

for every home, business and industrial need!

UNIVERSAL ELECTRIC POWER AND LIGHT PLANTS



New, low-cost, lightweight, air-cooled 3500 watt model.



New popular diesel model has 25,000 watt capacity.

New models . . . both gasoline and *diesel* series . . . fastest deliveries . . . sure to please prices—that sums up Universal Electric Power and Light Plants—the fastest growing line today!
Whatever you want in the broad 250 watt to 55 kw range, Universal has it. Models for emergency, intermittent or constant service—anywhere. Air-cooled types, water-cooled multi-cylinder models. All controls. All offering definite weight- and space-saving advantages. Get all the facts!

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treat 'em Rough
- the Reliable
KNOPP
Voltage Testers
can "take it"

have the Patented Prod-Mount

Cost Less!

You don't baby the Knopp Voltage Testers. They're built to withstand the shocks of rugged daily use.

To save your time in testing you get the original patented Prod-Mount in the housing, making this tester easier and safer to use. You get the safety of dual indication of voltage by solenoid and neon lamp working independently. The scale readings are positive. Signal is by hum and vibration. Insulated for maximum protection.

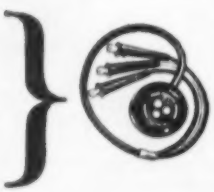
It tells quickly if the circuit is open or closed; magnitude of voltage between 110 and 600 a-c or d-c, pure or rectified; 25 to 60 cycles.

The Knopp Voltage Testers have won fame from coast to coast among engineers, electricians and power companies. So why pay more for a tester when the Knopp Voltage Tester gives you more features and more value at less cost.

There are two models to choose from; pick up one at your dealer today or write for illustrated, free descriptive Bulletin No. 425.

The KNOPP Phase Sequence Indicator

60 v. to 600 v.; 25 to 60 cycles; Rotating Indicator shows sequence A-B-C or C-B-A. Lightweight. Compact. Big time-saver.



KNOPP INC.

Founded in 1928 by Otto A. Knopp under the name of Electrical Facilities Inc.

4232 Holden St. Oakland 8, Calif.

of the Southwestern Chapter in Oklahoma City that "nowhere in this country is there a shop which has not benefited from NISA." Young, however, was concerned with the low profits which he feels many small shops are working for. He suggested a "resistance to any price policy that will deprive you of the profit to which you are entitled."

• • • •

In his talks before recent NISA chapter gatherings across the country NISA President Charles J. Covington has been urging shop owners and managers to set down their company policies in writing. He believes there is a natural tendency on the part of management to avoid doing this in order to make exceptions in certain cases. "Write it down and stick to it," he advises.

NISA Publicity Counsel Horace Barks, managing editor of NISA NEWS, advised members of the Southwestern Chapter in a talk before the Oklahoma City meeting September 22, to cooperate with the trade press to gain wider publicity within the industry.

• • • •

Larsen-Hogue Electric Co. of Los Angeles has purchased Pomona (California) Electric Machinery Works and will operate the firm as a wholly-owned subsidiary.

• • • •

Ray Horton of Daley Electric Co., Phoenix, Ariz., has opened another shop in Yuma, Ariz.

• • • •

Charles J. Briner, board chairman and founder of the St. Louis electric company bearing his name, died of infirmities September 23. He was 90 years old.

Mr. Briner founded the electrical contracting and motor repair firm in 1895 and remained active until shortly before his death. The shop did much of the wiring for St. Louis trolley lines and the St. Louis World's Fair of 1904. He is survived by his brother Fred who joined him in the business in 1897, the firm then being known as C. J. and F. E. Briner until 1945 when it became Briner Electric Co.

Surviving are two sons, Herbert F. and Charles E., both active in the business, a daughter, Mrs. W. A. Kamp, and four grandchildren.

• • • •

West Virginia Armature Co. was host to the West Virginia chapter of NISA October 10 in Bluefield. An Anaconda Copper representative conducted a program on service salesmanship. At a meeting of the chapter August 8 in Logan, a general discussion was

conduit of columbus

Elbows

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have smooth, work-speeding raceways

Conduit of Columbus elbows are U.L. approved. They are available in sizes ½" to 6". Sizes ½" to 2" are conveniently cartoned and all are shipped promptly from factory or from one of ten strategically located warehouses.

CONDUIT PIPE PRODUCTS CO.,

Conduit of Columbus COLUMBUS, OHIO

SOLD ONLY THROUGH WHOLESALERS

Electricians love it...

It's brand NEW

Pastushin *Clip-It saves time and effort

Ever try to hold a bunch of wires and clamp them securely at the same time? Let Clip-It do the work – This punched spring steel clip holds securely to the bolt on the electric wiring clamp while you tighten. Available in all sizes to fit clamp attachment bolts. Write for samples and quantity prices.

NEW–EXCLUSIVE

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5651 WEST CENTURY BLVD., LOS ANGELES, CALIFORNIA

Developers and Manufacturers of Aircraft Fasteners

held by members from seven shops in the state.

• • • •

San Diego Chapter met September 4 in Lawton's Dining Room, La Mesa, Calif. to hear President Charles Norris report on the NISA Convention. The group plans a Christmas Party December 14.

• • • •

Quaker City Chapter met September 12 and heard Robert Denham of General Electric speak on trends and developments in magnet wire. Norman Schuele of Philadelphia and Milton S. Weaver, Inc., Lansdale, Pa., are new members of the group.

• • • •

A meeting of three NISA chapters, the Pacific Northwest Conference, was held in Seattle at the Ben Franklin Hotel on October 5. British Columbia, Puget Sound and Oregon chapters met for the third consecutive year.

• • • •

North Central Chapter met in La Crosse, Wis. September 21-22. National officers Paul Sievert of Sievert Electric Co., Chicago, and Frank W. Ross, Ross Electric Motor Shop, Fairmont, Minn., were present to hear the program which included presentations by In-Sink-Frator Manufacturing Co. and Brook Motor Corp. Women guests held a separate program which included a Mississippi River cruise.

• • • •

A joint meeting of NISA's Niagara and Ontario chapters, another international gathering of the Association (the Pacific Northwest Conference being the other), was held September 15 in Niagara Falls, Ont., at the Park Hotel. The two chapters toured the Sir Adam Beck Power Plant. NISA's Executive Committee were guests.

• • • •

In New York, the New York Metropolitan Chapter convened for its first fall meeting on September 20 at Gondolier Restaurant. Walter F. Hugger of Sun Chemical Co. spoke on salesmanship. Tentative dates for future meetings include February 21 for "Ladies' Night" and March 23 for a foremen's meeting.

• • • •

In Boston, New England Chapter had its first meeting of the fall at the Hotel Bradford.

• • • •

Mid-South Chapter's third quarter meeting was held in Memphis on September 15. Brook Motor Corp. made a presentation. Bruce Tomlin of the U. S. Bureau of Apprenticeship was a speaker. The chapter took a steamboat ride aboard the sternwheeler Memphis

KOHLER Electric Plants
for portable, low-cost power wherever needed

MODEL 2.5M25, *2500 watts, 115 volt AC. Manual starting.*

Take your own portable electricity to the job and avoid expense, delays, of temporary power-line hookups. Kohler Electric Plants cut work time—operate saws, drills, other power tools used in wiring jobs. Also available: stand-by models to maintain home, public or commercial electrical equipment when central station power is cut off by storms, floods or accidents. Sizes, 500 watts to 35 KW. Write for folder M-18.

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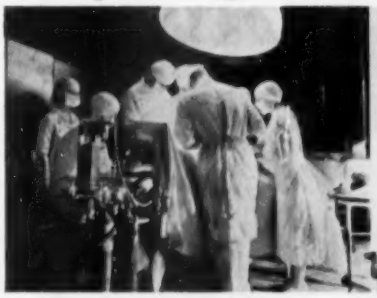
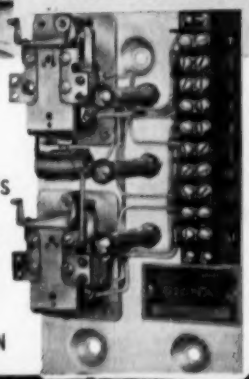
AIR-COOLED ENGINES • PRECISION CONTROLS

Safeguard against shock and Spark Hazards



GROUND DETECTOR RELAY
FOR UNGROUNDED EQUIPMENT IN HOSPITAL OPERATING ROOMS



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SAFE PRACTICE
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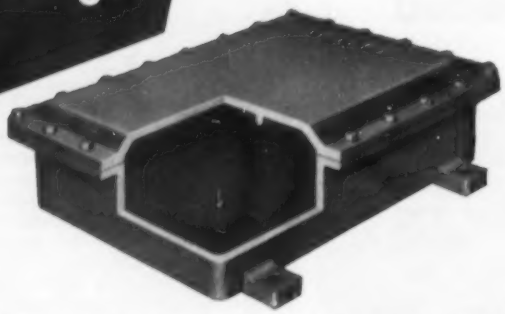
Signal Engineering & Mfg. Co. has changed its name to
Wheelock SIGNALS
RELAYS W S LONG BRANCH, N. J.

Explosion-proof Housings cast aluminum



Non-sparking cast aluminum, strong and rustless. Available in a wide range of standard and special sizes.

Lightweight, easily mounts onto equipment. Drilled and tapped to specifications. Made to Underwriters and Military Specifications.

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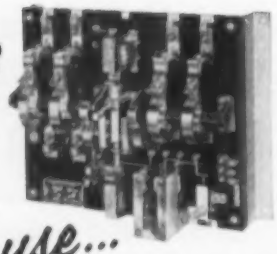
FOR *POWER* THAT'S ALWAYS ON THE JOB use...



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Zenith Automatic Transfer Switches assure full protection against *any* failure of regular voltage. Transfer to emergency power in a fraction of a second is automatic at 70% of line voltage. Regular power is restored at 90% of line voltage.

Simple design . . . sturdy construction . . . switches lock mechanically through trouble-free toggle action . . . no springs, latches or delicate mechanisms.

Available electrically or mechanically held, 30 to 400 amps.

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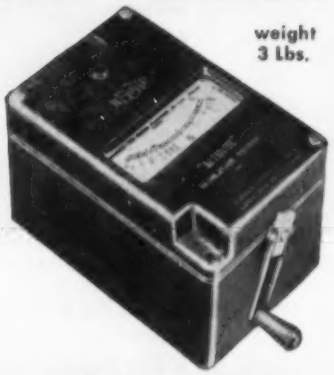
155 WEST WALTON STREET • CHICAGO 10, ILL.

LOW PRICE SMALL SIZE

weight 3 Lbs.



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Range 0-50 megohms. True Ohmmeter, independent of generator speed. Furnished with genuine leather carrying case, 6' test leads, 50 megographs.

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HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK 7, N. Y.

Queen. Insulation & Wires, Inc., sponsored a barbecue.

• • • •

William P. Kilgore of Employer's Association of Chicago spoke to that city's chapter, Central District Chapter of NISA, on September 11. Included was a presentation: "P.S. An Answer to any Business's Biggest Problem" by Harry L. Brownfield of The Standard Register Co., Dayton, Ohio.

• • • •

Behr Machinery & Equipment Corp. of Rockford, Ill., has bought the liquidated stock of Buckeye Trading Corp. of St. Louis.

• • • •

Joe Schaeffer of Carl I. Schaeffer Electric Co., St. Louis, has been named chairman of the Inter-Industry Coordinating Committee of the St. Louis Electrical Board of Trade.

• • • •

Redmond Electric Co. of Cleveland has bought the Waltz Electric Co. of that city and the combined firms will be known as Redmond-Waltz Electric Companies.

Local AW Bureaus Now Total 111

There were 111 local Adequate Wiring bureaus in operation, as of Oct. 5, including three new units.

The Iowa City bureau was licensed on Aug. 3, to cover Iowa City and parts of Johnson county. On Aug. 6, the Newaygo County (Mich.) bureau was licensed, with headquarters in Muskegon. On Sept. 17, permission to operate the certification plan was given to the Northeastern Connecticut bureau.

NAWB has announced that the 13th annual Adequate Wiring conference will be held Feb. 28-Mar. 1 at the LaSalle hotel, Chicago. Program details will be announced later.

TAKING NOTES during open forum on Code rules at Western Section, IAEI conference are E. L. Ralston, Jr., Honolulu, Territory of Hawaii and M. K. Dewey, electrical inspector of Cedar Falls, Iowa.

WHAT'S THE LAW?

By Jack and Michael Strauss

QUESTION: Does an electrical contractor owe a duty to a property owner to fulfill his subcontract?

Mr. Popkin hired Stevens, a general contractor, to build several apartment houses for him. During the course of the work, the generous and trusting property owner thought nothing of paying the general contractor in advance.

The result? The money ran through the general contractor's hands like sand. When it came time to pay his electrical subcontractor for work completed, there was no money left to make the payment.

"No money . . . no work," was the subcontractor's defiant answer as he pulled his employees off the job. "When I get paid, we'll be back."

The next morning, the harrassed Mr. Popkin sought out the electrical subcontractor.

"If you'll complete the job," he said, "I promise to pay you the entire balance due under your contract with Stevens. When you finish, the money will be waiting for you in my office. My promise is as good as gold."

Without delay, the electrical subcontractor had the work completed. But, when the payment was demanded, Mr. Popkin's promise proved to be only as good as "fool's gold."

"A promise isn't binding unless something of value is received in return," he told the electrical subcontractor. "Since you were already duty bound to complete the work under your contract with Stevens, you never gave me anything in exchange for my promise. Therefore, I don't have to pay you."

Outraged, the electrical subcontractor sued the property owner on his promise.

THIS WAS THE DECISION: The Court ruled that Mr. Popkin had to pay. In so holding, the Court said the electrical subcontractor was under no obligation to Mr. Popkin to fulfill his subcontract with Stevens. By doing so, he had given Mr. Popkin sufficient exchange or consideration for his promise to make it binding.

(Based upon a 1943 New Jersey Decision.) State laws vary. For personal guidance, see your local attorney.

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For Superior Quality
√ Check these features

- ☐ Pure copper, 100% conductivity
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- ☐ Compact—rugged
- ☐ Advanced designing
- ☐ Sound engineering
- ☐ Speedy installation
- ☐ Cool operation—takes overload
- ☐ No special tools needed
- ☐ All screws wax-treated for better clamping

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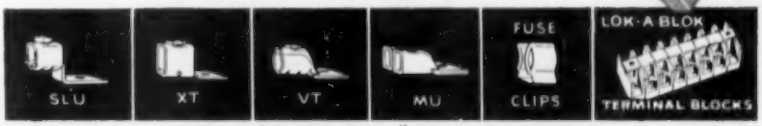
ALL THESE FEATURES AT LOW COST

Your √ Test Will Prove ILSCO Superiority Over Cost Or Any Other Type Lugs



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4. Brook national advertising and sales promotion, backed by Brook field men, helps you sell—makes your job easier.
5. Complete Customer Satisfaction—they come back to the Brook Dealer for more Brook Motors.

Write for BROOK 10-point Dealer Franchise Plan.

FAST DELIVERY OF ALL POPULAR MODELS

Brook Motors are available from warehouse at Chicago, Dallas, Jersey City, Los Angeles, Memphis, St. Paul, Salt Lake City, San Francisco, Savannah, Seattle, Tampa, and other major distributing points.

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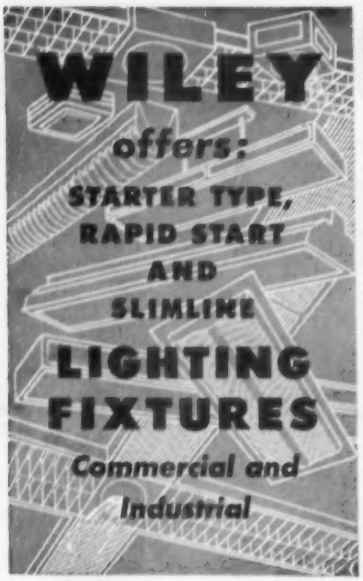

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DATES AHEAD

National Electrical Manufacturers Association — Annual meeting, Traymore Hotel, Atlantic City, N. J., November 12-16.

Operations Research Society of America—Tenth National meeting, Hotel Mark Hopkins, San Francisco, Calif., November 15-16.

American Institute of Electrical Engineers—Winter general meeting, Hotel Statler, New York, N. Y., January 21, 25, 1957; Summer General Meeting—Montreal, Que. (Canada), June 24-28; Pacific General Meeting—Yakima, Wash., August 28-30; Fall General Meeting—Chicago, Ill., October 7-11.

Plant Maintenance & Engineering Show and Conference—Public Auditorium, Cleveland, Ohio, January 28-31.

National Electrical Week — An all-industry event, February 10-16.

National Electric Sign Assn.—Annual convention and exhibit, Sheraton Park Hotel, Washington, D. C., February 24-28.

American Society of Heating and Air-Conditioning Engineers — Annual meeting, Chicago, Ill., February 25-28.

13th International Heating and Air Conditioning Exposition — Chicago, Ill., February 25-March 1.

National Electrical Manufacturers Assn.—Edgewater Beach Hotel, Chicago, Ill., March 11-14.

Illuminating Engineering Society—Regional Conferences: Pacific Northwest—Empress Hotel, Victoria, B. C., March 28-29; South Pacific Coast—Statler Hotel, Los Angeles, Calif., April 3-5; Inter-Mountain — Hilton Hotel, Albuquerque, N. M., April 11-12; Southwestern—Holiday Inn, Oklahoma City, Okla., April 28-30; Midwestern—Astor Hotel, Milwaukee, Wisc., May 9-10; Great Lakes—Pantlind Hotel, Grand Rapids, Mich., May 13-14; Canadian — Sheraton Brock Hotel, Niagara Falls, Ont., May 16-17; East Central—William Penn Hotel, Pittsburgh, Pa., May 23-24; Northeastern—Hotel Statler, New York, N. Y., June 12-13.

Fourth National Electrical Industries Show—Sponsored by Eastern Electrical Wholesalers Assn., 71st Regiment Armory, New York City, April 8-11.

National Association of Lighting Maintenance Contractors—Fourth Annual Meeting, Hotel Muelebach, Kansas City, Mo., April 29-May 1.

Air Conditioning and Refrigeration Institute—Annual meeting, The Homestead, Hot Springs, Va., May 6-8.

Chicago Electrical Industry Show—Conrad Hilton Hotel, Chicago, Ill., June 4-6.

Illuminating Engineering Society—51st Annual National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

LIVE BETTER ELECTRICALLY

Sound Powered
Telephones

need no batteries

Never fail in any emergency because they operate without current of any kind over a distance of many miles. Can be moved with the job as construction progresses or serve permanently where power failures may occur. In outdoor and indoor models.

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It doesn't Cost... it Pays to use...

HELWIG CARBON BRUSHES

Brushes are manufactured to size — need not be cut down to fit commutator. It pays to protect your electrical equipment with HELWIG CARBON BRUSHES.

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CARBON PRODUCTS
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MILWAUKEE 10, WIS.

Among the Manufacturers

Headquarters Announcements

Westinghouse Electric Corp., Bloomfield, N. J.—Product departments and their managers in the reorganized Lamp Division are: Large Lamps, C. E. Erb; Miniature Lamps, C. W. Flood, Jr.; Photolamps, Joseph Schlig; Lamp Parts, E. W. Noxon; Ken-Rad Lamps, J. G. Carroll.

General Electric Co., Schenectady, N. Y.—Carter L. Redd, commercial vice president for the Southeastern district; Joseph F. Welch, manager of small Integral Motor Dept.

Auth Electric Co., Inc., Long Island City, N. Y.—Walter A. Scrivens, vice president and general manager.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.—W. W. Gilmore, vice president.

Square D Co., Detroit, Mich.—Wilbur H. Peter, Jr., vice president, also manager of the Electric Controller Division.

General Electric Co., Nela Park, Cleveland, Ohio—Thomas M. Wallace, manufacturing manager of the Large Lamp Dept.

Pittsburgh Reflector Co., Pittsburgh, Pa.—Robert C. Zinsmeister, president.

R.C.S. Tool Corp. has relocated to 227 E. Front St. (P. O. Box 661) Bloomington, Ill.

Accurate Mfg. Co., Garfield, N. J.—Arthur W. Rista, assistant sales manager.

General Cable Corp., New York, N. Y.—R. T. Hurley and R. K. Paynter, Jr., members of the board of directors.

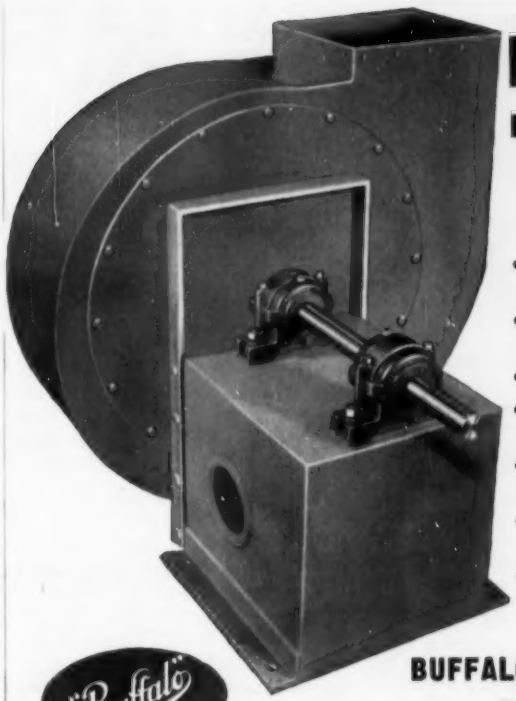
Essex Wire Corp., Ft. Wayne, Ind.—Midland Wire Corp., Tifflin, Ohio and Midland Wire Div. of Essex have been merged into the Paranite Wire & Cable Div. of the parent company.

Lightolier, Inc., Jersey City, N. J.—E. H. R. Blitzer, president; Martin Thurnauer, vice chairman.

Whitney Blake Co., New Haven, Conn.—Walter Kesteloot, assistant to the president.

General Electric Co., Pittsfield, Mass.—Louis E. Newman, manager of newly formed Insulating Materials Section of Chemical Materials Dept.

Pryne & Co., Inc., Pomona, Calif.—Richard V. Burns, vice president in charge of manufacturing.



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- Available for temperatures up to 1000°F.
- For draft, cleaning, conveying, many other jobs!
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BUFFALO, NEW YORK

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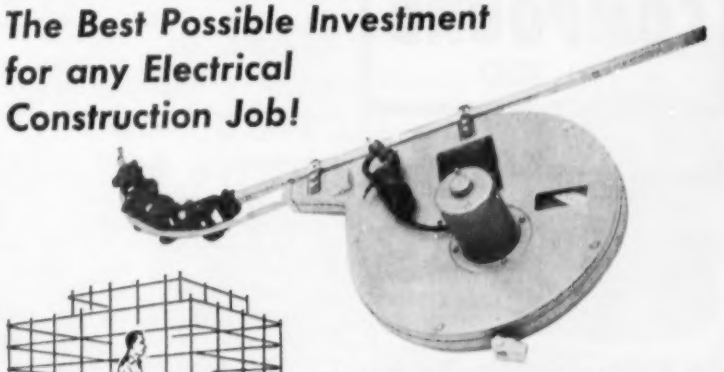

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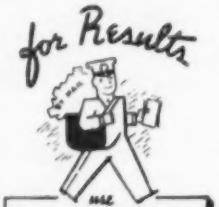

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ELECTRICAL STANDARDIZATION

[FROM PAGE 113]

secondary coil moves on the core (just the same as in a series street-lighting transformer) and closes the contacts mechanically. A common return circuit is provided for all probes in a tank group. It will be noticed, also, that all relay contacts are on the "line" side of their respective loads.

The relays for each tank group are housed in a standard 24-in. by 24-in. by 10-in. junction box. The same type of housing is provided for the flasher and the relays. The double-pole toggle switches controlling each tank group or alarm section, are located at convenient points.

The stainless steel probes were improvised in the field as shown in Fig. 5. They were made from ¾-in. stainless steel pipe. A ⅜-in. bolt was threaded into the top of the "hot" probe. This assembly was clamped into a standard hole in a GRFX box, insulation being provided by fiber washers and tubing. The "ground" or return probe was attached directly to the box. The box also served as a take-off point for the red light.

Color coding was maintained throughout the system. The common return from the probes was separate from the common return of the lights. 600-volt insulation was used on the 24-volt circuit.

All lighting units, with the exception of those mounted on poles, were located so as to make scaffolding or lamp changes unnecessary when relamping.

General style and brands of fixtures were chosen according to conditions of location or use. Swivel suspensions were used in areas subject to vibration. Among the incandescent fixtures were RLM dome, prismatic reflector, and vapor tight globe. The fluorescent lights were all 4-ft, rapid start units.

Aside from the placement and the fluorescent standardization, the electrical engineer regarded the lighting installation as fairly conventional and conservative. Typical light intensity measurements are: more important work areas, 8 to 12 fc.; near machinery, 10 to 15 fc.; at car dumper and truck unloading, 20 fc.; control rooms, 40 to 60 fc.; offices, 50 to 70 fc.; laboratory benches, 65 to 80 fc.

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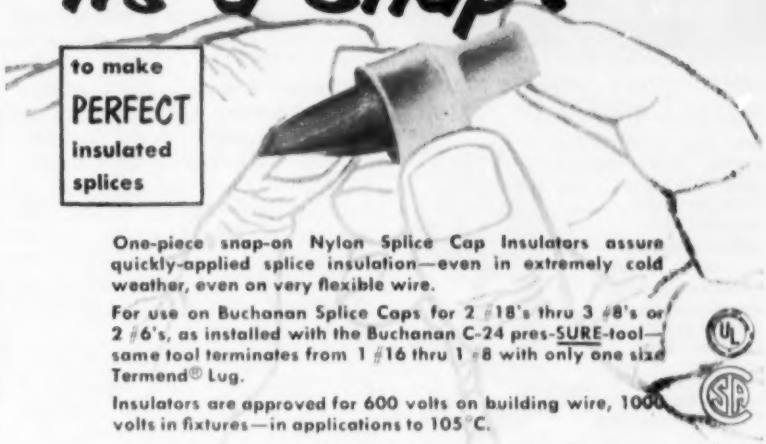

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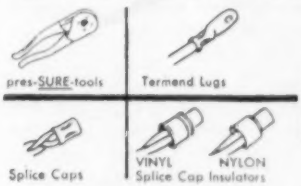

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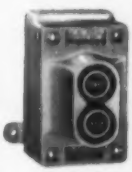

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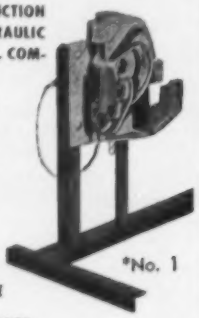

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CONTROL OF LIGHT INTENSITIES

[FROM PAGE 103]

Two general types of circuits for fluorescent dimming are shown in Figs. 13 and 14. In Fig. 13 the controller is an adjustable reactor which provides the widest range in dimming and best starting conditions. An auxiliary fixed reactor is shunted from the open end of the adjustable reactor to the sliding contact. The auxiliary reactor serves to keep the voltage from rising to excessive heights across the adjustable reactor with attendant heating and noise.

A 360-watt autotransformer dimmer which is of such size that it may be included in the standard 2-in. by 4-in. studded walls of a residence is shown in Fig. 15. It may be connected as an adjustable autotransformer for incandescent or fluorescent dimming, or as an adjustable reactor for fluorescent dimming. It must be remembered that the dimming system for hot cathode fluorescent lamps uses the rapid start fluorescent system.

With this system, the precautions of proper grounding and proper wiring polarity must be employed for good starting and operating. If this system is properly integrated, if the lamps, ballasts, controller, and wiring are in accordance with accepted and recommended practices, the dimming results are exceedingly satisfactory.

The information presented here covers all the standard types of dimmers which are in common usage. These types are listed and compared in Table I, which points out some of the salient advantages and disadvantages of each. It is considered that either the adjustable autotransformer dimmer or the magnetic amplifier dimmer will best fulfill nearly all of the applications.

In the application of any types of dimmers, one should keep in mind—

a. The input power, ac or dc, voltage, frequency, number of phases, number of wires.
b. The number of circuits which are to be dimmed and the wattage of each.
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[SEAL] JANET A. HARTWICK.
(My Commission expires March 30, 1957)

SELLING ELECTRICAL LIVING

[CONTINUED FROM PAGE 105]

strates the salient points of the electrical layout. Finally the builders' brochure describes in detail the benefits of several elements of the equipment.

It is interesting to note that of the 28 building features listed in this booklet, fully half of them are electrical. Truly a design for better living electrically.

Builders Beir and Higgins are pleased with the results. They have found today's home buyers increasingly aware of electrical living and the convenience it affords. "Home building has become a highly competitive business in this area," remarks Dick Higgins. "These electrical features in our houses accent the functional beauty concept of the Briar Hill designs. We feel these features have contributed substantially to our success with this project."

Results of the sales program have been extremely favorable for Valley Electric. Partners Graham and Trifilio report their profit margin has moved up to a very satisfactory percentage. Volume continues high and, most interestingly, inquiries about dimmers, low-voltage switching and other such items have been coming in from people who already own houses. Visiting the model house at Briar Hill, they have noticed these electrical devices and wanted them for their own houses.

As Graham says, "You really don't have to sell electrical living, just let people know what it can do."

ATTENDING the convention of the New York State Association of Electrical Contractors and Dealers, at Saranac Inn, N. Y., were R. L. Pattengell, Brooklyn; A. J. Melita, Jr., Corona; and G. W. Kleinknecht, Jr., New York City.

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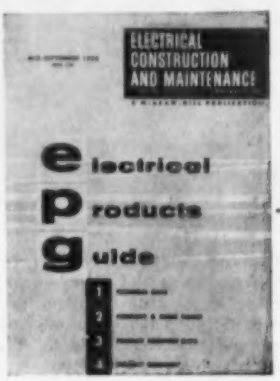

• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

Something NEW Has Been Added To—

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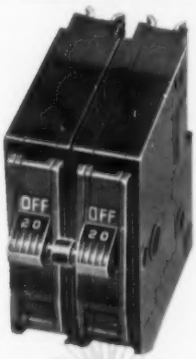

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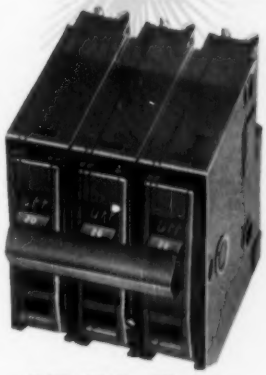
3-POLE



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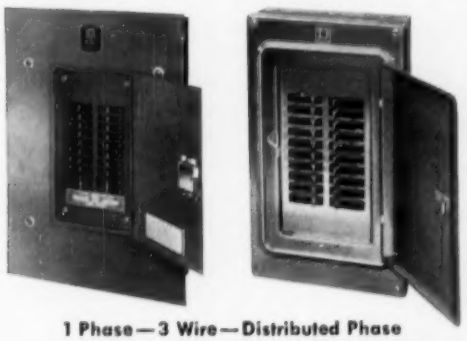

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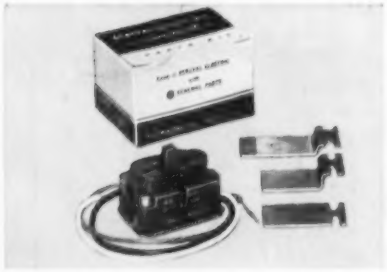
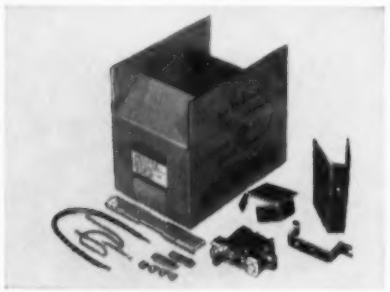
6 KITS TO MODIFY GENERAL ELECTRIC STARTERS

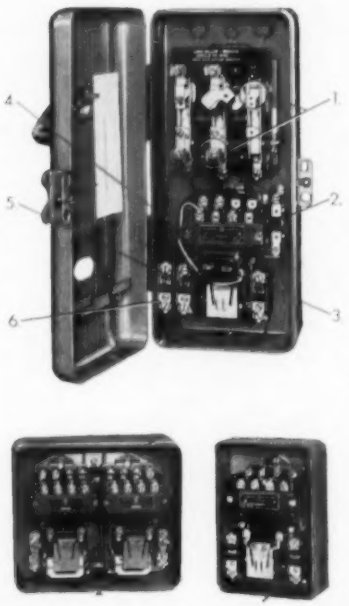


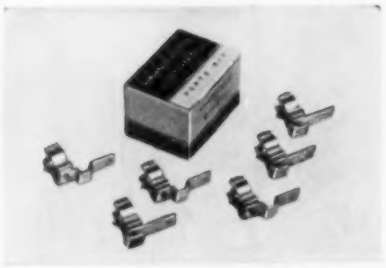
4. SELECTOR SWITCH fits into same cover knockout as the pushbutton unit, and gives you a choice of ON, OFF, or AUTO setting.

5. STRONGBOX COIL can be changed quickly and easily for different voltage ratings. There is no need to disturb the power wiring.

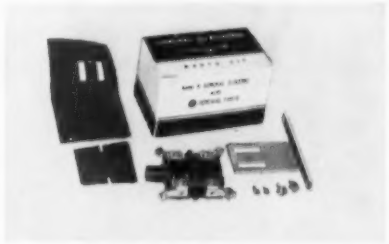


6. 3rd OVERLOAD RELAY can be added, whenever needed, to G-E magnetic starters. A screwdriver is the only tool necessary.





1. FUSE CLIPS can be easily changed on all General Electric combination starters for use with different line current ratings or voltages.



2. AUXILIARY INTERLOCKS can add up to four additional control circuits to provide maximum flexibility for G-E magnetic starters.

3. PUSH BUTTON for START-STOP operation can be mounted through the knockout provided in the cover of G-E magnetic starters.

KITS PERMIT ON-THE-SPOT MODIFICATION OF G-E STARTERS

These six modification kits modify any G-E across-the-line non-reversing, combination, or reversing starter. This means that your distributor can give you off-the-shelf delivery on all of these forms or, if you prefer, you can make the modifications yourself. Any one of these modifications can be made quickly and easily. All necessary parts and instructions are furnished in each kit, and a screwdriver is the only tool needed.

Send in the coupon below for a new bulletin, complete with ordering data and "how-to-do-it" pictures of each kit. Your nearest General Electric Distributor will be glad to give you additional information.

Advertising and Sales Promotion Section B733-16
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